

DINAMAP™ PLUS **Vital Signs Monitor** **Models 8710 and 8720**

Operation Manual

CRITIKON

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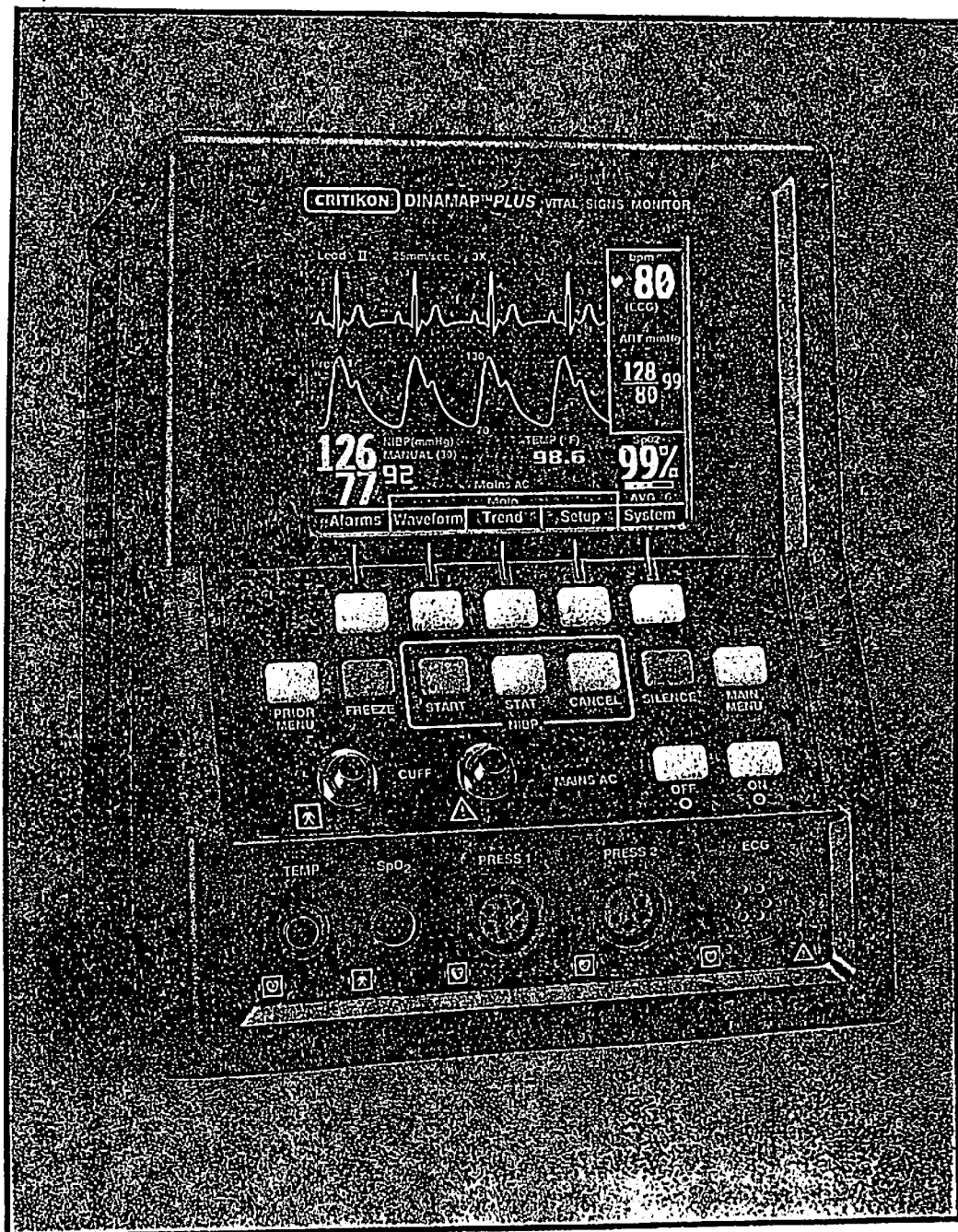
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DINAMAP™ PLUS Vital Signs Monitor Model 8720

Section 1. Introduction

MANUAL PURPOSE

This Operation Manual was prepared for the operator of the DINAMAP™ PLUS Vital Signs Monitor. This manual contains installation and operation instructions, device applications, limitations, and routine performance verification procedures. *To achieve satisfactory results, the operator must read this manual thoroughly before attempting to use the Monitor.*

MANUAL ORGANIZATION

Section 2 describes the DINAMAP™ PLUS Monitor and provides information on the 8700 series product configurations, operating features, controls and indicators, and specifications. Installation, operating warnings, power on, screen display information common to all parameters, and maintenance are described in Section 3. Sections 4 through 8 describe the individual parameters' functions and operations. Alarms are described in Section 9. Information on the optional Printer Module is contained in Appendix A, Printing Specific to Model 8726.

MANUAL CONVENTIONS

All references to Model 8710 in this manual implies the information is common to 8711, 8712, 8713, and 8714. Likewise, all references to Model 8720 include 8721, 8722, 8723, and 8724.

MANUAL EFFECTIVITY

Reissues

Changes to this manual, either in response to user input or to continuing product improvements, are accomplished through reissue.

Change Information Sheets

Changes occurring between reissues are addressed through Change Information Sheets and replacement pages. If a Change Information Sheet does not accompany this manual, it is correct as printed.

DINAMAP™ PLUS Monitor Models 8710 and 8720 Operation Manual

Errors, Omissions, Incorrect Data

If, in the normal use of this manual, errors, omissions, or incorrect data, are noted please complete the Publications Change Request Form located in the back of this manual. Submit the form to:

Critikon, Inc.
Marketing Services
4110 George Road
Tampa, Florida 33634

RELATED PUBLICATIONS

Instruction Labels

Two permanently affixed labels, one on each side of the monitor, contain condensed operating precaution information.

Service Manual

The DINAMAP™ PLUS Monitor Service Manual (776-532) contains service and repair parts information directed to qualified service personnel.

WARNING

To avoid personal injury, the user should not perform any servicing unless qualified to do so.

Section 2. Product Description

INTRODUCTION

This portable monitor is designed for noninvasive and invasive monitoring of patients in numerous clinical settings. The monitor can accompany patients to and from various hospital departments (for example, emergency, radiology, recovery, cardiac step-down) and can be used during many specialized procedures in satellite areas, or during surgeries in physicians' offices or ambulatory surgery centers.

The monitor can be battery powered when connected to an optional battery module, Critikon Reorder No. 8725, or an optional printer module, Critikon Reorder No. 8726. The monitor can also run on AC power using a standard power cord.

The battery module and the printer module use two user-replaceable batteries. Battery usage is sequential. As the life of one battery diminishes, operation automatically switches to the other. The drained battery can be replaced with a fully charged spare for continuous and indefinite battery operation.

OPERATING FEATURES

- ☐ An electroluminescent (EL) display provides high visibility and clarity in most light conditions. Image does not disappear or distort when viewed from an angle.
- ☐ Optimizes display area. Data and waveforms are displayed only when parameter is active.
- ☐ PRIOR MENU and MAIN MENU keys enable easy navigation through software.
- ☐ Audible and visible indications if monitored parameters exceed user selectable high/low limits. Abnormal system conditions and hardware failure are also indicated.
- ☐ User selectable audio volume for alarms and pulse signal. As a safeguard, alarm volume cannot be set to zero.
- ☐ Easy to use. Five 'soft' keys and menu-driven software enable the clinician to easily alter displays and change selections. Five hard keys are provided for frequently used functions.

- ☐ Lightweight and portable. Upright design, compact size and a variety of optional mountings enable the monitor to be used in many clinical settings.
- ☐ Easy to access. All patient connections are made at the front of the unit.
- ☐ Optional battery operation. User replaceable and rechargeable batteries for indefinite battery operation.
- ☐ Optional battery-operated thermal printer. Prints waveforms and tabular patient data as they occur or from memory.
- ☐ Host communication. Serial output via rear panel connector.

The DINAMAP™ PLUS Monitor is available in three models. The 8700 series features: noninvasive blood pressure (NIBP) and pulse oximetry (SpO2) in Model 8700; Model 8710 adds ECG to the features of the 8700; Model 8720 includes NIBP, SpO2, ECG, temperature, and two invasive pressure channels.

Each model is available with English, German, French, and Japanese labeling and operates from any AC power source. Entries in the table below are Critikon reorder numbers.

Model Numbers	Parameters	Language	Reorder Numbers
8700	NIBP/SpO2	English	8700
8701	NIBP/SpO2	English	8701
8702	NIBP/SpO2	English	8702
8703	NIBP/SpO2	German	8703
8704	NIBP/SpO2	French	8704
8710	NIBP/SpO2/ECG	English	8710
8711	NIBP/SpO2/ECG	English	8711
8712	NIBP/SpO2/ECG	English	8712
8713	NIBP/SpO2/ECG	German	8713
8714	NIBP/SpO2/ECG	French	8714
8720	NIBP/SpO2/ECG/Temp/IF	English	8720
8721	NIBP/SpO2/ECG/Temp/IF	English	8721
8722	NIBP/SpO2/ECG/Temp/IF	English	8722
8723	NIBP/SpO2/ECG/Temp/IF	German	8723
8724	NIBP/SpO2/ECG/Temp/IF	French	8724

8710

8720

8720

TABLE 2-1. FRONT PANEL CONTROLS AND INDICATORS

ITEM	NAME	FUNCTION
1	Display screen	This electroluminescent (EL) panel displays patient data, waveforms, alarm messages, various user selectable options, an indication of battery operation and battery life, and the 'soft' key labels.
2	'Soft' keys	Function of the five (5) white 'soft' keys varies by location in the software menu.
3	PRIOR MENU	This white key allows you to return to the menu previous to the menu currently displayed, that is, the last menu level.
4	FREEZE	This grey key 'freezes' 6 seconds of the current ECG waveform. This includes 3 seconds of data before and the immediate 3 seconds of realtime data after the keypress. If the screen display contains three (3) waveforms when you press FREEZE, the bottom waveform will be displaced by the 'frozen' waveform. A FREEZE keypress with a lead off sounds an 'invalid keystroke' tone, which is 3 rapid, low audio tones.

TABLE 2-1. FRONT PANEL CONTROLS AND INDICATORS
Continued

ITEM	NAME	FUNCTION
5	START	Press this green key to initiate an NIBP determination in either manual or auto mode. ☐ Manual mode is entered when power is first applied. In manual mode, a single blood pressure (BP) determination is made only when you press START. ☐ In auto mode and during wait time, a START keypress initiates one BP determination immediately and subsequent determinations at the end of the cycle time shown on the display. The cycle timer starts when auto mode is first entered and is restarted at the beginning of each automatic determination. Pressing START during a determination in-progress or while in stat mode will have no effect. Pressing START during a low battery condition shall not initiate a determination and will cause an invalid keystroke tone.
6	STAT	Press this yellow key to select the stat mode of NIBP monitoring. Stat mode can be entered at any time from manual or auto mode by a STAT keypress and the monitor will perform continuous determinations for a 5-minute period. Audible NIBP alarms are disabled in stat mode. The occurrence of an out-of-limits (NIBP) alarm will not be displayed and will not inhibit the series of determinations or display of values.

TABLE 2-1. FRONT PANEL CONTROLS AND INDICATORS
Continued

ITEM	NAME	FUNCTION
6	STAT Cont'd	At the end of the 5-minute period, the monitor will return to the mode previous to the initiation of stat mode. If that mode was manual mode, the monitor returns to the wait time state. You can exit stat mode any time by pressing CANCEL. This action returns the monitor to the mode prior to stat mode. If that mode was auto, the cycle time will begin when CANCEL is pressed.
7	CANCEL	This red/orange key performs several functions for the noninvasive blood pressure parameter (NIBP). Pressing CANCEL will ☐ stop an NIBP determination-in-progress and deflate cuff, ☐ exit stat mode, and ☐ clear some procedural alarms. CANCEL has no effect on internal system alarms.
8	SILENCE	This grey key temporarily silences the audible alarms for any parameter. Pressing SILENCE will initiate a 3-minute silencing of active audible patient and procedural alarms. Some alarms are silenced for 3 minutes each time SILENCE is pressed while a patient or procedural alarm is active. A SILENCE keypress permanently clears an IP and Temperature DISCONNECTED alarm, and printer error conditions if a Printer Module is connected.

TABLE 2-1. FRONT PANEL CONTROLS AND INDICATORS
Continued

ITEM	NAME	FUNCTION
8	SILENCE Cont'd	A SILENCE keypress does not silence an NIBP overpressure alarm. Alarm silence will be visually indicated by 'ALARMS SILENCED' in the message field. Patient, procedural, and system alarm messages display in the message field. The alarm message alternates with the silence 'on' indicator ('ALARMS SILENCED') for all alarms. A SILENCE keypress during silence 'on' will disable silence, including the power on silence. Pressing SILENCE when <i>no</i> alarms are active will mute new alarms occurring within the 3-minute silence period.
9	MAIN MENU	This white key returns the screen presently displayed to the main menu.
10	CUFF	Screw type connectors for hose connection to make a noninvasive BP determination. Either cuff hose may be connected to either connector.
11	MAINS AC	This illuminated green LED lights whenever the power cord is plugged into an AC outlet, when the monitor is powered ON, and when the batteries are charging.
12	Power ON/OFF	These pushbutton switches control the power to the monitor.
13	TEMP	An input connector port for the YSI 400 Series temperature probe, Model 8720.

TABLE 2-1. FRONT-PANEL CONTROLS AND INDICATORS
Continued

ITEM	NAME	FUNCTION
14	SpO ₂	A 7-pin input connector port for the oximeter sensor cable.
15	PRESS 1,	Two female connector ports for transducer cables for hemodynamic monitoring, Model 8720 only.
16	PRESS 2	
17	ECG	An AAMI Standard 6-pin input connector port for the ECG cable.
	BF Symbol	This symbol complies with Type BF as defined in IEC Publication 601-1 (1988) and BS 5724-1 (1989).
		This symbol complies with Type BF—defibrillator protected—as defined in IEC Publication 601-1 (1988) and BS 5724-1 (1989).
	ATTENTION Symbol	Consult accompanying documents.
	Heart Symbol	This symbol complies with (defibrillator protected) Type CF as defined in IEC Publication 601-1 (1988) and BS 5724-1 (1989).
		This symbol, which appears on a label atop the unit, indicates hazards arising from dangerous voltages. Refer servicing to qualified service personnel.

TABLE 2-2. REAR PANEL CONTROLS AND INDICATORS
Continued

ITEM	NAME	FUNCTION
7	Module Cover Access Plate/ Attach- ment Screw	This cover access plate can be removed to attach an optional module, using the module attachment screw which holds the cover plate. (However, after cover access plate removal, attach a module ribbon cable connector to the 40-pin connector port.) If module is removed, the cover access plate must be re-installed.
		Data input/output Signal The maximum non-destructive voltage that may be applied, between the conductors: - 2 VDC to + 10 VDC
12V		This symbol indicates a DC input socket with 12—32 VDC F5.0A
		Attention: Consult accompanying documents

SPECIFICATIONS

Mechanical

	WEIGHT	HEIGHT	WIDTH	DEPTH
Monitor	9.8 lb/4.45 kg	9.25 in.	7.20 in.	8.50 in.
Battery Module*	3.85 lb/1.75 kg	1.50 in.	7.20 in.	8.00 in.
Printer Module*	6.0 lb/2.7 kg	3.32 in.	7.12 in.	8.13 in.

Display: Electroluminescent, 320 x 256 pixels;
viewing area 3.80 in. W x 3.0 in. H

* with batteries

Environmental

Operating temperature	50.0° to 104.0°F; 10.0° to 40.0°C
Storage temperature	-29.0° to 167.0°F; -34.0° to 75.0°C
Relative humidity	0% to 90% noncondensing
Altitude	-1000 ft to 15,000 ft; -304.8 m to 4572 m

Electrical

AC Input Voltage	88-268 VAC; 47-63 Hz
AC Input Power	20-35 watts typical, including battery charger; 70 watts maximum
AC Line Fuses	2.0 A (F2A, fast blow), 250V, 3AG
DC Input Voltage	12 to 32 VDC
DC Input Power	15-21 watts typical; 42 watts max.
DC Line Fuse	5.0 A (F5A, fast blow), 125V, 2AG
Storage Battery Fuses	5.0 A (F5A, fast blow), 125V, 2AG
Leakage Current	<100 μ A

Power Cable

Domestic: 10 ft, detachable, blue jacketed, 16 gauge terminated with 3-prong hospital grade plug
International: 10 ft, detachable, blue jacketed, 16 gauge unterminated

Battery or Printer Module Storage Battery Operation

Two (2) batteries; sequential operation, one (1) hour per battery. Standard 10 hour rating is 2.3 Amperes per hour.

Section 3. Installation, Setup and Maintenance

DESCRIPTION

This section contains installation and setup information, operating precautions, and some cleaning and maintenance information. Power on and menu display information common to all parameters and custom features are described.

UNPACKING

Inspect the carton carefully for any signs of damage. Remove the monitor from the carton and inspect the unit. Retain all shipping materials for inspection by the carrier in case of shipping damage or for reshipment, if necessary, to Critikon. Account for and inspect each item before storing the shipping materials.

Content Checklist

- 1 DINAMAP™ PLUS Vital Signs Monitor
- 1 Operation Manual
- 1 Cuff, Standard Adult
- 1 Pneumatic Hose (blue) with Connectors, 12 ft. — Adult/Pediatric
- 1 SpO2 Cable
- 1 Clip-on Finger Sensor
- 1 NIBP Calibration Kit
- 1 Power Cord
- 1 ECG Cable with Lead Wires (color coded) with 1 Set of (3) ECG Electrodes
- 1 Temperature Cable, Model 8720 only

MISSING ITEMS

If an item is missing or damaged, call 1-800-237-2033, Critikon's product and customer support (for parts, parts services, and customer service, press 2).

INSTALLATION and SETUP

The Monitor may be placed upon a horizontal surface or clamped to a pole mount (Critikon Reorder No. 8733). Four rubber feet are attached to the bottom of the monitor and the optional printer and battery modules to provide a firm, skidfree placement on a horizontal surface.

Electrical connections are made at the rear of the unit with accommodations for a 10 foot AC power cord and customer-supplied communications connector and cable.

Remember to provide clearance for the front-attached hoses, probes, sensors, and cables and the rear-attached power cord and communications cables.

The external connections are confined to connecting the AC power cord and making connections to an external computer or optional DINAMAP™ PLUS Module (printer or battery).

It is advisable to connect the AC power cord to the monitor and plug it into a hospital-grade AC outlet rated at the same voltage and frequency as printed on the monitor's serial number label when it is first unpacked.

**OPERATING
WARNINGS,
PRECAUTIONS,
CAUTIONS, and
NOTES**

WARNINGS

- ☐ Do not use the monitor or SpO2 sensor in the presence of magnetic resonance imaging (MRI) devices. There have been reports of sensors causing patient burns when operating in an MRI environment.
- ☐ To avoid personal injury, the user should not perform any servicing unless qualified to do so.
- ☐ For continued protection against fire hazard, replace only with same type and rating of fuse. Disconnect power supply before servicing.

PRECAUTIONS

- ☐ Read and have a thorough understanding of the material presented in the manual.
- ☐ Read and observe all the caution and warning labels affixed to the monitor.
- ☐ Place the monitor on a rigid, secure surface or attach securely with the pole clamp.
- ☐ If the integrity of the electrical ground is in doubt, disconnect the power cord from the power source, and operate the monitor using an optional battery module.

PRECAUTIONS Continued

- ☐ Arrange the power cord, pneumatic hoses and all cables carefully so they do not constitute a hazard.
- ☐ Verify calibration and ensure that the display is functioning properly before operating the monitor.
- ☐ Allow for heat dissipation by ensuring that the vents in the chassis are unobstructed.
- ☐ Do not place fluids on the monitor.
- ☐ Danger: Explosion Hazard—Do not use the monitor in the presence of flammable anesthetics.
- ☐ If the accuracy of any determination reading is questionable, first check the patient's vital signs by alternate means and then check the monitor for proper functioning.

CAUTIONS

- ☐ Caution: Do not gas sterilize or autoclave.
- ☐ Caution: To reduce the risk of electric shock, do not remove cover or back. Refer servicing to qualified servicing personnel.

NOTE

- ☐ Waveforms may be distorted and readings inaccurate when electrosurgical equipment is used in proximity to the monitor.

**INFORMATION
GENERAL TO
MONITORING ALL
PARAMETERS**

Power On—Initial Factory Setting

When the monitor is powered on, it runs a brief self-test, runs an audio test for audio tones, and shows a power on display screen for a few seconds. The power on display screen will indicate the model and serial numbers. See Figure 3-1, Power On Display Screen.

At power on, preset default limits for all patient alarms, alarm volume, and QRS volume are in effect. All alarms are suspended for three (3) minutes after power on to allow you to 'connect' the patient. Thereafter, all alarms are active immediately.

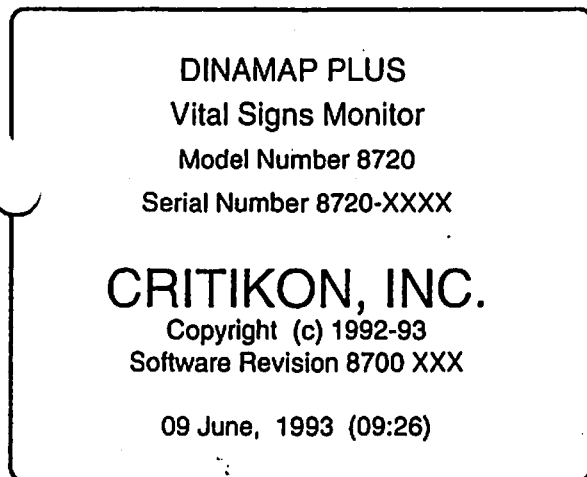


Figure 3-1. Power On Display Screen

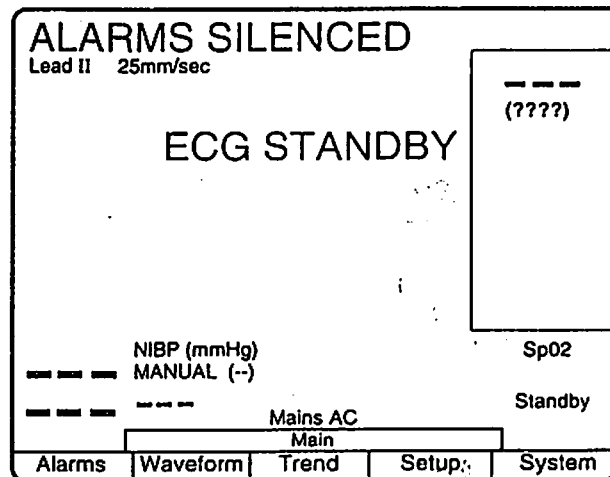


Figure 3-2. Main Menu

After Initial Power On—Monitor Memory

Note that after the initial power on with factory settings, the monitor may be 'reconfigured'. The monitor remembers the settings in effect at power off and applies them at the subsequent power on. For example, monitor memory remembers the following settings:

NIBP	Auto or Manual mode; Cycle time
NIBP/SpO2	Large-size number format
Temperature	°F or °C
Alarms	Volume: QRS and Alarm
	Limits: If activated before any Alarm menu changes (Main Menu→System→Last)
Printer	Printer menu settings

TABLE 3-1. MAIN MENU

MAIN Menu		
	Action	Result
8710 or 8720	ALARMS Key: an Alarms keypress...	...causes entry into the Alarms menu to change alarm limits, and alarm and QRS volumes.
8710 or 8720	WAVEFORM Key: a Waveform keypress...	...causes entry into the Waveform menu to change waveforms, sweep speed, and the NIBP and SpO2 number size to display.
8710 or 8720	TREND Key: a Trend keypress...	...causes entry into the Trend menu to view or print trend data entries.
8710 or 8720	SETUP Key: a Setup keypress...	...causes entry into the Setup menu to make changes to each parameters' setup.
8710 or 8720	SYSTEM Key: a System keypress...	...causes entry into the System menu to make custom changes to alarms, printer, and time; and service for biomed personnel.
8710 or 8720	MAIN MENU Key: a Main Menu keypress...	...causes return of Main Menu to the display.
8710 or 8720	PRIOR MENU Key: a Prior Menu keypress...	...causes the previous screen to return to the display.

Main Menu

The Main Menu screen is the next screen to display; it is the main operating menu of the monitor. At power on, the ECG and pulse oximetry parameters are in standby mode, and the status message flashes 'ALARMS SILENCED' in the Alarm Message field for three minutes. Waveform field 1, which is reserved for ECG *only*, will show 'ECG STANDBY'. Refer to Figure 3-2, Main Menu. A MAIN MENU keypress always returns you to the Main Menu.

Note for BioMedical Personnel

HOW TO CHANGE SpO2 POWER-ON DEFAULT

If it is desired by the supervisor/department head to change the oximetry parameter *from* the power-on default of standby mode *to* the power-on default in operate mode, you will be able to do so. Simply follow these steps:

1. In the Main Menu, press the System soft key.
2. Press the Service key.
3. Enter the Service code numbers: 2, 2, 1, 3.
4. Press the SpO2 key. (Observe that the sensor's red/infrared indicators light; this is normal activity.)
5. Press the Default key. (Each Default keypress toggles between standby and operate mode.)
6. Power off the monitor; then power on again.
7. Verify that the pulse oximetry power-on default is in the intended mode (operate or standby).

This information regarding entry into the Service menu is intended for biomedical personnel use only.

CALIBRATION

Calibration is not required at the initial power-on. The pulse oximetry, ECG, invasive pressures, and temperature parameters do not require calibration. However, the noninvasive blood pressure parameter does require calibration every 12 months or when there is doubt about the validity of the readings. Calibration should be performed by qualified service personnel.

SOFT KEYS in MAIN MENU

The soft keys appearing in the Main Menu are Alarms, Waveform, Setup, Trend, and System. They provide entry into the (named) submenus and are described as follows.

Alarms

Alarms Menu

Alarm preset or default values in the Alarms menu are for convenience only; preset or default values are not intended for all clinical situations. Preset/default limits and alarm ranges are listed in the section appropriate to each parameter as well as in Section 9, Alarms.

You enter the Alarms menu from the Main Menu via an Alarms soft key press, or through each parameter's Setup menu. The Alarms menu is described in detail in Section 9.

CUSTOM ALARM SETTINGS

The alarm limits in effect prior to power off can be returned at a subsequent power on by a System keypress in the Main Menu, and then a Last keypress if you take this action before you make *any* changes in the Alarm menu.

TABLE 3-2. ALARMS MENU

ALARMS Menu		
	Action	Result
8710 or 8720	Auto Set or ↑ or ↓ Keys: Take at least one measurement. Based on patient's current reading in the appropriate Group, press Auto Set OR press ↑ or ↓ arrow keys...	...to automatically or manually set patient alarm limits (to change from preset/default alarm values).
8710 or 8720	After power Off, and subsequent power On, press System key (in Main Menu) and then press Last key...	...to cause alarm limits in effect at power Off to be returned.
8710 or 8720	Group, Select, and ↑ or ↓ Keys: Press Group to choose 'Volume'; and/or press Select, and/or ↑ or ↓ arrow keys...	...to cause QRS and alarm to increase or decrease volume.

Waveform

Waveform Menu

The Waveform menu is entered from the Main Menu. Press the Waveform soft key to enter the Waveform menu. When you press Waveform, three soft keys may be present: Pleth, Speed and Format. These keys allow for waveform manipulation and the display of large-size numbers for NIBP and SpO2.

PLETH

The Pleth soft key is present if the SpO2 is in operate mode. Each Pleth keypress toggles the plethysmographic (SpO2) waveform between 'on' and 'off', that is the pleth waveform shows on the screen or disappears from the screen. A Pleth keypress to enable the waveform while in large-size numbers causes the numbers to revert to normal size.

If SpO2 is in standby, only Speed and Format are present.

SPEED

The Speed soft key is used to select the sweep speed of the displayed waveforms. The preset speed is 25 mm/sec. Each Speed keypress rotates through 50 mm/sec., 12.5 mm/sec., 25 mm/sec., and so on. All waveforms will display at the designated speed.

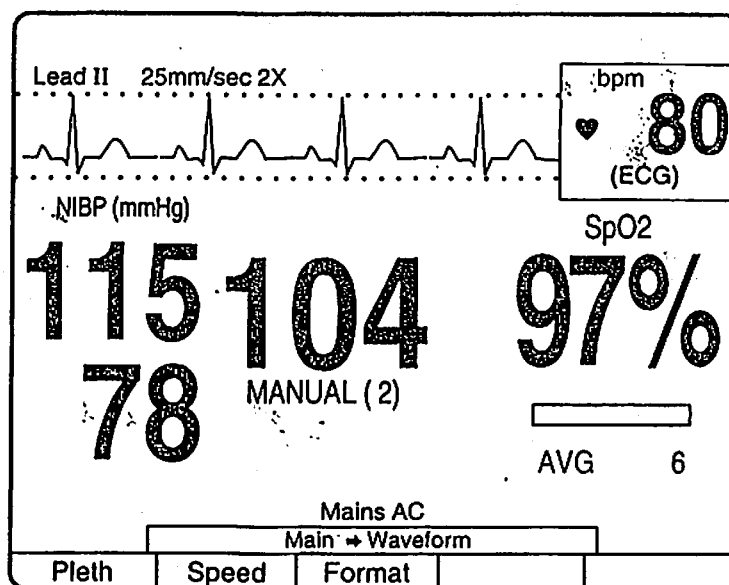


Figure 3-3. Large Number Display

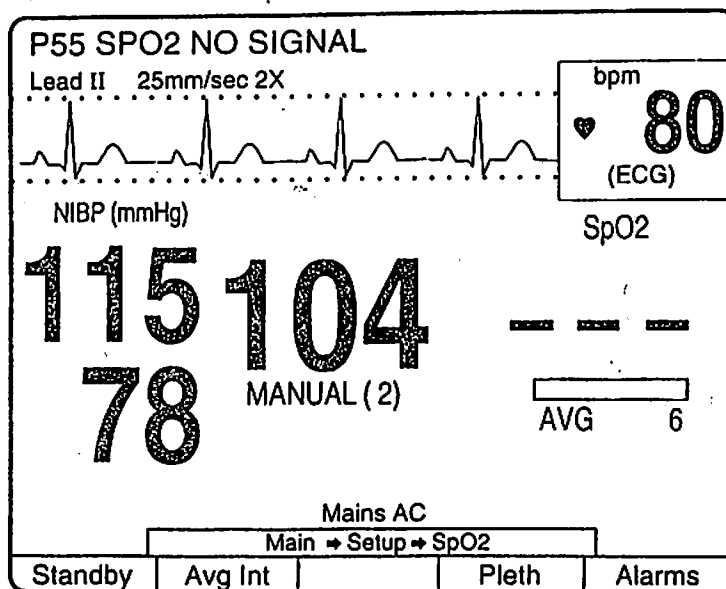


Figure 3-4. SpO2 in Large Number Display

FORMAT/LARGE-SIZE NUMBER DISPLAY

The Format soft key is used to select large-size *numbers* for NIBP and SpO2 to display on the screen. See Figure 3-3. The option to increase the number size allows for better visibility of measurements in those clinical situations where the clinician deems it necessary. If SpO2 is in *operate* mode with the sensor connected but no signal detected, the screen shows as illustrated in Figure 3-4. If SpO2 is in *standby* mode, the dashes, signal strength bar graph, average interval indicator, and Pleth key disappear from the screen.

A Format keypress toggles between the normal size number and the large-size number screen display. A Pleth or a Freeze keypress, or an IP connection while in a large-size number display causes the screen to return to the normal size number display.

Pressing Format while IP is connected will cause large-size numbers to overwrite the IP measurement and waveform. The IP alarms remain in effect, however.

TABLE 3-3. WAVEFORM MENU

WAVEFORM Menu		
	Action	Result
8710 or 8720	Pleth Key: With SpO2 in operate mode with normal size numbers, a Pleth keypress...	...toggles the pleth waveform between 'on' and 'off'.
8710 or 8720	Pleth Key: With SpO2 in operate mode with large-size numbers, a Pleth keypress...	...returns the display to normal size numbers, and shows the pleth waveform.
8710 or 8720	Speed Key: A Speed keypress...	...steps through 50, 12.5 and 25mm/sec; causes all waveforms to display at chosen sweep speed.
8710 or 8720	Format Key: A Format keypress...	...toggles between normal size numbers and large-size numbers to display onscreen for NIBP and SpO2.
8720	A Format keypress with IP connected...	...overwrites/removes IP measurement and waveform, but IP alarms remain in effect.
	An IP connection when in large-size number display...	causes return to normal size number display
8710 or 8720	A Power Off keypress with a subsequent Power On keypress...	causes the monitor to 'remember' and return the number size selected prior to Power Off on the screen display.
8710 or 8720	FREEZE Key: A Freeze keypress while in large-size number display...	...causes a return to normal size numbers in display screen.

Trend

Trend Menu

The Trend menu can be entered *only* from the Main Menu. A Trend keypress causes tabular trend data to be displayed. See Figure 3-5. All alarms are in effect and all out-of-limit patient alarms will flash on the display if they were in violation of alarm limit settings at the time they were recorded; all hard keys and parameters remain active.

TIME DATE	RATE	SpO2	NIBP
09:20	80	96	138/82
06/28			(94)
09:25	80	95	138/82
			(94)
09:30	80	96	138/82
			(94)
09:35	80	95	138/82
			(94)
09:40	80	96	138/82
			(94)
09:45	80	95	138/82
			(94)
10:00	80	95	138/82
			(94)

Mains AC			
Main → Trend			
Older	Newer		

8710

TIME DATE	RATE	SpO2 TEMP	NIBP	PRESS1	PRESS2
09:20	80	96	138/82	123/88	
06/28			(94)	(101)	
09:25	80	95	138/82	111/70	
		97.3F	(94)	(87)	
09:30	80	96	138/82	108/68	
		97.3F	(94)	(84)	
09:35	80	95	138/82	123/88	
		97.0F	(94)	(101)	
09:40	80	96	138/82	111/70	
		97.3F	(94)	(87)	
09:45	80	95	138/82	108/68	
		97.3F	(94)	(84)	
10:00	80	95	138/82	108/68	
		97.3F	(94)	(84)	

Mains AC					
Main → Trend					
Older	Newer	Print	Print All		

8720

NOTE: An asterisk (*) preceding the time indicates the time has been changed

Figure 3-5. Trend Display Screen—Tabular

At power on, a record is made indicating only the time and date on one line, distinguishing it from other trend records. Trend entries are made every 5 minutes or when an NIBP determination is available. However, after an NIBP determination, the timer is reset for 5 minutes.

Current data appears at the bottom of the display with older data above. The date stamp appears once with the displayed data for that particular date, and remains with the oldest displayed data. Trend holds 300 lines of data, approximately 24 hours, depending on the number of NIBP determinations. (For example, an NIBP determination in Auto mode every minute reduces trend time to 4-1/2 hours.)

If the time is re-set through the Time Set menu, the trend times will be changed to reflect the time 're-set'. The trend data accumulated prior to the time re-set will be preceded by an asterisk (*) in the display screen. To exit the Trend menu, press either the Main Menu or Prior Menu hard key.

OLDER

The Older soft key is present

- ☐ at power on irregardless of data or record available,
- ☐ if previous or older data records are available, or
- ☐ or after Trend memory has been erased.

Each Older keypress brings forth one screenful consisting of seven previous data records to the screen display.

NEWER

The Newer soft key is present only when there is new data available. Each Newer keypress brings forth anywhere from one new data entry to one full screenful of previous records to the screen display.

PRINT

The Print soft key—visible only when the Printer Module is attached—is used to print one screen or page of data records. Press Print to print the trend data record(s) in tabular (text) format.

PRINT ALL

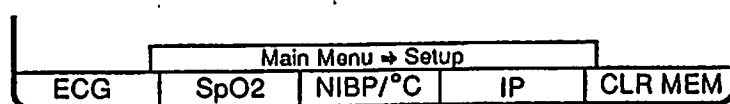
The Print All soft key—visible only when the Printer Module is attached—is used to print all data records in Trend memory. Press Print All to print all trend data record(s). To stop a Print All record, press the Continuous key (on the Printer) twice.

TABLE 3-4. TREND MENU

TREND Menu		
	Action	Result
8710 or 8720	Every 5 minutes or whenever an NIBP determination is made, a new Trend entry...	...is recorded in the display (with older data above the entry).
8710 or 8720	OLDER Key: Each Older keypress...	...brings up one screenful (that is seven previous records) of older data records, if available
8710 or 8720	NEWER Key: A Newer (key present only if new data available) keypress...	...brings forth from one entry to one or more screenful of data records, if available.
8710 or 8720 with Printer Module	PRINT Key: A Print keypress...	...causes a printout of one screen/page display, which can have from one to seven data records onscreen.
8710 or 8720 with Printer Module	PRINTALL Key: A PrintAll keypress...	...causes a printout of all screen displays (up to about 300 lines of data).
8710 or 8720 with Printer Module	Two Continuous  keypresses on the Printer...	...cause the printout to stop.

Setup

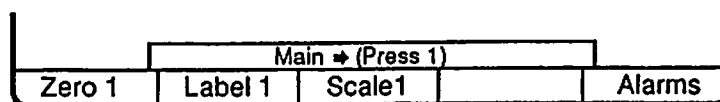
Setup Menu



↑ If IP(x) Connected

Setup Menu

The Setup menu—entered from the Main Menu via a Setup keypress—is your entry to each parameters' (ECG, SpO2, NIBP/°C or NIBP, and IP) particular setup menu in which you can make changes in the factors involved in monitoring that parameter. The last soft key, Clr Mem, in this menu is discussed at the end of Setup.



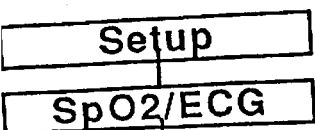
Invasive Pressure Setup Menu

NOTE

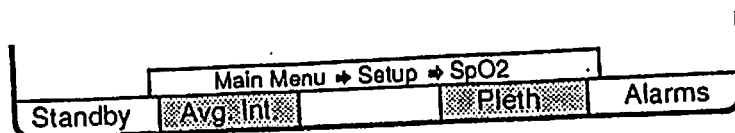
When you connect an IP channel, the monitor automatically enters the invasive pressure Press1 or Press2 Setup menu so that the invasive pressure transducer may be zeroed. In the Menu Label Bar, the IP channel is enclosed in parentheses, (Pressx); when an *automatic* entry to Setup menu is made.

A temperature probe connection to the monitor activates temperature measurement.

When the ECG cable is connected to the monitor and electrodes are placed on the patient, the ECG operate mode is entered automatically. However, to enter operate mode for pulse oximetry or ECG if ECG is in standby, or to change any factors in monitoring any parameter, follow this procedure.

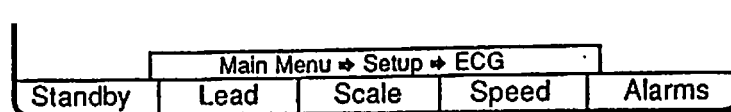


1. Press SETUP.



SpO2 Setup Menu — These (↑) appear in operate mode only

OR



ECG Setup Menu

2. Press SpO2 to enter the SpO2 Setup menu. Standby and Alarms are the only two soft keys to appear. Note that the Avg. Int. and Pleth soft keys appear on the screen only in SpO2 operate mode; they disappear from the screen when pulse oximetry is in standby mode. Or press ECG to enter the ECG Setup menu.
3. Press Standby to place SpO2 or ECG in operate mode. The Standby key toggles from standby to operate mode.

This example is but a capsule look at the Setup menu. Basically you follow this procedure to change factors in monitoring each parameter. Refer to Sections 4 through 8 which describe the setup and specific details in monitoring each parameter.

A Main Menu keypress returns the display to the Main menu; a Prior Menu keypress returns the display to the previous menu.

CLEAR MEMORY

The Clr Mem soft key allows you to erase the Trend memory when the key is pressed and held for three (3) seconds. In addition, a Clr Mem keypress will erase the currently displayed values of the last NIBP determination.

Clr Mem

TABLE 3-5. SETUP MENU

SETUP Menu		
	Action	Result
8710 or 8720	ECG Key: An ECG keypress...	...causes entry to ECG setup menu enabling operator to choose mode, lead, scale, and alarms.
8710 or 8720	SpO2 Key: A SpO2 keypress...	...causes entry to SpO2 setup menu enabling operator to choose mode, average interval, waveform, and alarms.
8710	NIBP Key: An NIBP keypress...	...causes entry to NIBP setup menu enabling operator to choose auto or manual mode, cycle time, and alarms.
8720	NIBP/°C Key: An NIBP/°C keypress...	...causes entry to NIBP/°C setup menu enabling operator to choose NIBP auto or manual mode, cycle time, and alarms or to choose Temp in °C or °F and alarms.
8720	IP Key: If IPx connected, an IP keypress...	...causes entry to IP setup menu enabling operator to choose label, scale, and alarms.
	When IPx is initially connected, it...	...causes an automatic entry IP setup menu.
8710 or 8720	ClrMem Key: A ClrMem keypress held for 3 seconds...	...erases the Trend memory and the currently displayed NIBP values.

System

System Menu

The System menu can be entered *only* from the Main Menu. This menu accesses monitor system functions. If you press System, the soft keys present are Last, Printer, Time Set, and Service.

Last

LAST

The Last soft key is used if you choose to retrieve and apply the alarm and volume settings used prior to powering off the monitor, the 'last' alarm and volume settings.

Printer

PRINTER

The Printer soft key is used to enter the Printer menu which allows you to select various printer options in four groups: Waveforms, Alarms, Auto, and Speed.

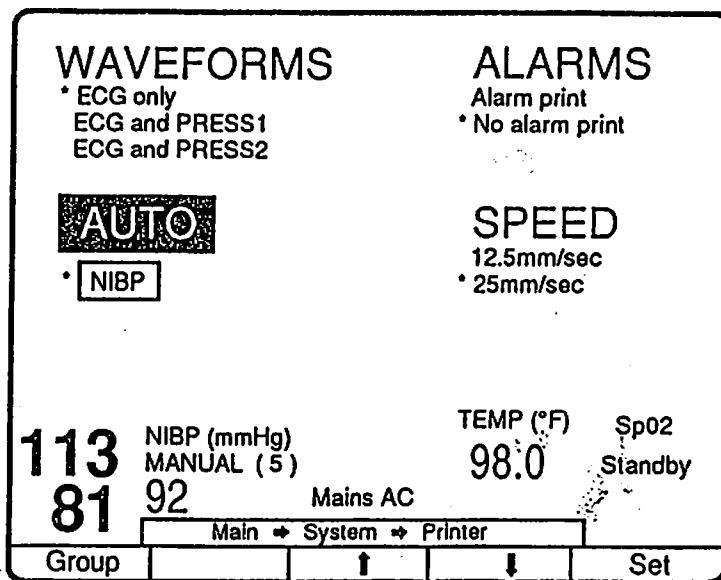


Figure 3-6. Printer Menu Display Screen

Entry to the Printer menu will show the first group to be highlighted and the first option selected to be 'boxed'. Basic movement within the Printer menu is simple.

- 1) Press Group to choose the group (Waveforms, Alarms, Auto, and Speed).
- 2) Press Select to make changes within the Group.
- 3) Press Set to 'set' the changes made.

Read "Appendix A—Printing Specific to Model 8726" for detailed information regarding printing. Press PRIOR or MAIN MENU to exit the Printer menu.

TIME SET

Time Set

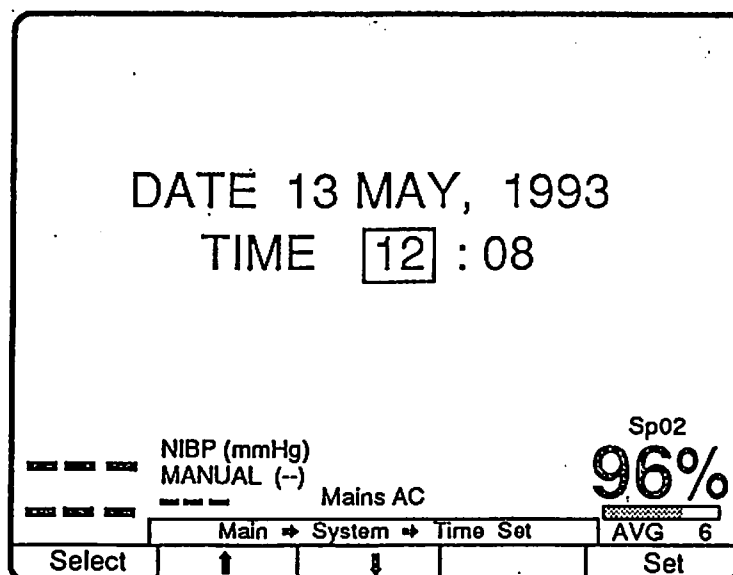


Figure 3-7. Time Set (Date or Time of Day) Display Screen

The Time Set soft key is used to change or set the date or time of day. Press Select to move the selection box and press up and down arrow keys to select time of day or date. Press the Set key to effect the choice. "INVALID" appears if you choose an invalid time or date. The time is based on a 24-hour clock. See Figure 3-7, Time Set Display Screen.

Service

SERVICE MENU

The Service soft key is to be used only by qualified service personnel to perform monitor system checks and tests. Biomed technicians/service personnel need a service code number to enter the Service menu. See Figure 3-8.

Press Prior Menu or Main Menu to exit the System mode.

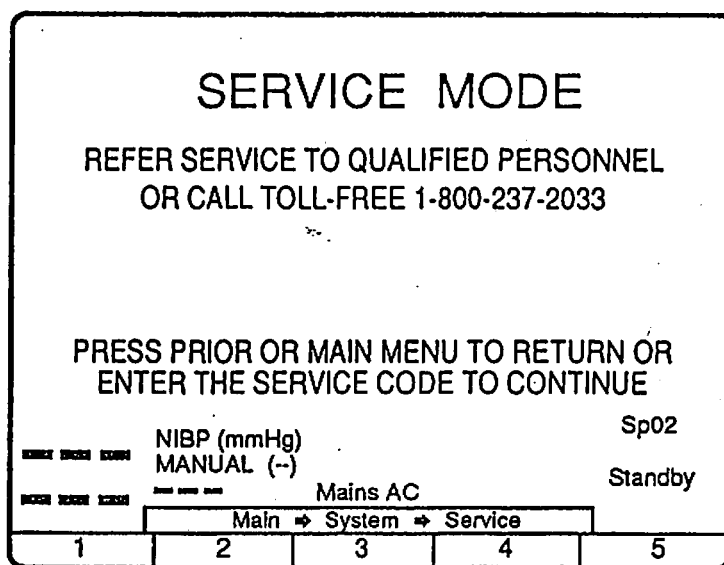


Figure 3-8. Service Display Screen

TABLE 3-6. SYSTEM MENU

SYSTEM Menu		
	Action	Result
8710 or 8720	LAST Key: A Last keypress...	...retains or retrieves the alarm and volume settings used prior to power off.
8710 or 8720 with Printer Module	PRINTER Key: A Printer keypress...	...causes entry to the Printer menu enabling operator to choose waveform(s), alarms, and AUTO for printout, and waveform speed.
8710 or 8720	TIME SET Key: A Time Set keypress...	...causes entry to Time and Date menu enabling operator to choose time and date.
8710 or 8720	SERVICE Key: A Service keypress...	...causes entry to the Service menu allowing the biomed/service personnel to change SpO2 power on default and to perform system checks and tests.

BATTERY or PRINTER MODULE CONNECTION

The battery or printer module is connected to the monitor by a ribbon cable which is attached to a 40-pin connector port. This port is under the cover plate at the rear of the monitor. Do not connect or disconnect while monitor power is on. Refer to the instructions provided with the optional modules (Battery Module 8725 or Printer Module 8726).

BATTERY OPERATION

Both batteries shipped with the optional modules must be charged completely prior to first use. They may be charged by using an external charger or by plugging the monitor with attached optional module (including batteries) into AC power. The batteries are charged sequentially for two to four hours per battery. The monitor may be used on AC power while the batteries are charging.

The monitor operates the same way with either battery-powered module as it does with AC power. However, when operating on battery, the screen will display two battery icons in the battery indicator field. The icons will indicate in increments the amount of battery power contained by each battery; an arrow points to the battery currently being used. The increments are 'shaded' in the battery icon. When the battery level is empty, the power source is switched to the remaining battery. When a battery is low, "LOW" will be indicated over the icon. For example,



If one battery is removed, the screen shows a single battery icon.

When operating on AC power, the screen will display a slightly different battery icon for each battery in the battery indicator field. The icons will contain a "C" in the icon if the battery is installed in the module, indicating the battery charger is active.

MOUNTING

Brackets are available to mount the 8700 series monitors to an I.V. pole. Refer to the instruction sheet provided with Pole Mount 8733.

MAINTENANCE

All repairs on products under warranty must be performed by Critikon personnel. Unauthorized repairs will void the warranty. Products out of warranty should be repaired by Critikon or a Critikon authorized affiliate repair facility.

Critikon's Service Policy requires that if the product fails to function properly or requires maintenance and technical assistance is required, contact your Critikon Technical Support. Also, refer to the Service Manual, LT776-532.

Cleaning**MONITOR**

The only maintenance routinely required is that the unit and accessories are to be kept clean and handled and used according to the instructions provided here.

The exterior of the monitor may be wiped clean with a cloth slightly dampened with mild detergent or normal hospital bacteriocides.

- ☐ Do not immerse unit.
- ☐ Do not clean with isopropyl alcohol or other solvents.

NONINVASIVE BLOOD PRESSURE (NIBP)

- ☐ The cuffs and hoses supplied with the unit should be inspected regularly for damage and wear and replaced, if necessary.
- ☐ The adult cuffs supplied for use with the monitor may be cleaned by hand washing in warm soapy water. Exercise care to ensure that no water enters the cuff or cuff hoses at any time. Should water accidentally enter the cuff it may be dried by passing air through the cuff.
- ☐ The neonatal cuffs are for single patient use and should be discarded if they become soiled.
- ☐ Cuffs and hoses should be cleaned with a cloth slightly dampened with mild detergent.
- ☐ Do not immerse hoses.
- ☐ Do not immerse cuffs without prior application of cuff hose caps.

ELECTROCARDIOGRAM (ECG)

The monitor is supplied with an interface cable and three ECG leads enabling connection between the unit and patient electrodes. Both the cable and ECG leads may be cleaned and disinfected by wiping with a 10% solution of household bleach, Amphyl™, a "green" soap and water solution, or Cidex™.

NOTE

Do not use alcohol to clean leads and cable since this will strip the protective plasticizers from the leads' and cable's jackets; this causes them to stiffen, become brittle, and break prematurely.

Armor All™ may be used to clean (but not disinfect) the ECG cable and leads and to restore some of the plasticizers.

Follow manufacturers' recommendations for dilution rate and use. These recommendations are not an endorsement of the manufacturers or of the effectiveness of these materials for cleaning or disinfecting.

Storage

If it becomes necessary to store the monitor for an extended period of time, disconnect the optional module and remove the batteries from the module. Replace the cover access plate, attach the original packing inserts, and place the unit into the original shipping carton.

Amphyl is a registered trademark of Sterling Winthrop Inc.

Cidex is a registered trademark of Johnson & Johnson
Medical Products, Inc.

Armor All is a registered trademark of Armor All Products Corp.

Section 4. Noninvasive Blood Pressure (NIBP)

DESCRIPTION

The DINAMAP™ *PLUS* Monitor uses the oscillometric technique to monitor the noninvasive blood pressure and to display systolic pressure, diastolic pressure, mean arterial pressure (MAP), and pulse rate* for neonates, children, or adults. The monitor senses cuff size and switches automatically from adult/pediatric monitoring to neonatal monitoring or vice versa. Results are shown on the front panel display. The operator may select:

- ☐ determination frequency in increments between one (1) and ninety (90) minutes;
- ☐ manual, auto, or stat operating mode to cover a variety of clinical situations; and
- ☐ systolic, diastolic, MAP, or pulse* values for high/low alarm limits.

DETERMINATION SEQUENCE and OSCILLOMETRIC TECHNIQUE

A determination sequence begins when:

- ☐ you press the START, Auto/Man, or STAT key;
- ☐ the cycle time expires in the auto mode;
- ☐ 15 seconds elapse after a patient alarm condition if no patient alarm condition existed before (auto mode); or
- ☐ an N99: No Determination alarm occurs (auto mode) (up to nine determinations are made in an attempt to clear the alarm).

The first determination sequence initially pumps up to a cuff pressure of about 170 mmHg for adult/pediatric patients, or 120 mmHg for neonates. After the initial pump-up pressure is reached, the monitor begins a stepped deflation sequence that first determines the systole, MAP, diastole, and pulse rate from pulses induced in the cuff at the varied pressure levels. This is the oscillometric method of determination and is accomplished by a sensitive transducer which measures cuff pressure and minute pressure oscillations within the cuff. See Figure 4-1, NIBP Determination Sequence.

The NIBP will not function during a low battery condition.

* pulse is not determined from ECG, IP, or SpO2

The monitor deflates the cuff one (1) step each time it detects two (2) pulsations of relatively equal amplitude. The time between deflation steps is dependent on the frequency of these matched pulses (pulse rate of the patient). However, if the monitor is unable to find any pulse within 1.6 seconds, it will deflate to the next step. The 'boxed' figure in the MAP field of the screen display depicts cuff pressure each deflation-step. The process of finding two (2) matched pulses at each step provides artifact rejection due to patient movement and greatly enhances the accuracy of the monitor.

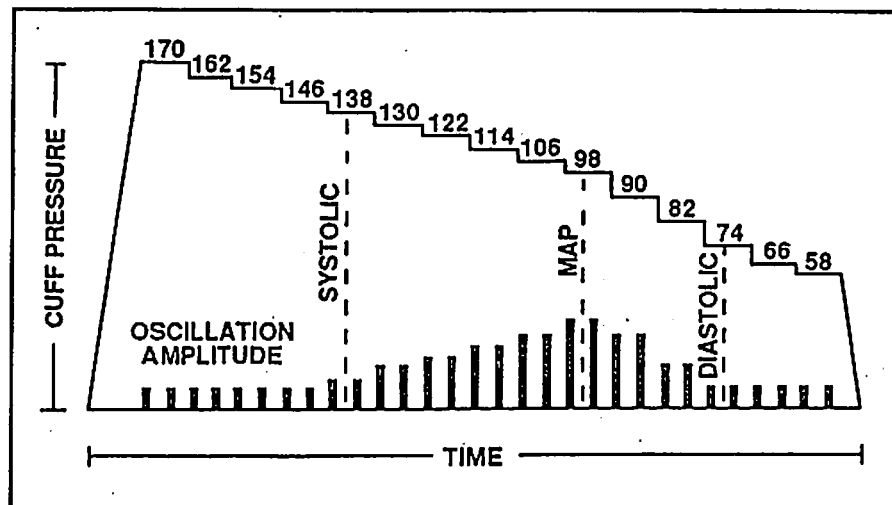


Figure 4-1. NIBP Determination Sequence

At each step the microprocessor stores cuff pressure, the matched pulse amplitude, and the time between successive pulses. The stepped deflation and matched pulse detection continues until diastolic pressure is determined, or when total cuff pressure falls below 7 mmHg. The monitor then deflates the cuff (to zero detected pressure), analyzes the stored data, and updates the front panel displays.

GENERAL OPERATING PARAMETERS

Maximum-Minimum Ranges

Maximum and minimum ranges of blood pressure and pulse rate determinations are shown in Table 4-1.

TABLE 4-1. MAXIMUM AND MINIMUM
DETECTABLE PRESSURE RANGES

PARAMETER	NEONATAL	ADULT/PEDIATRIC
Systolic Pressure	Max 190 mmHg Min 30 mmHg	Max 245 mmHg Min 30 mmHg
Diastolic Pressure	Max 160 mmHg Min 10 mmHg	Max 210 mmHg Min 10 mmHg
MAP (Mean Arterial Pressure)	Max 170 mmHg Min 20 mmHg	Max 225 mmHg Min 20 mmHg
Pulse Rate	Max 220 bpm Min 40 bpm	Max 200 bpm Min 40 bpm

**BASIC OPERATING
CYCLE**

The operating cycle is composed of four parts: inflation time, deflation time, evaluation time, and wait time. Wait time varies from mode to mode. Wait time is affected by the cycle time (auto mode) or operator intervention (manual mode). See Figure 4-2, Basic Operating Cycle.

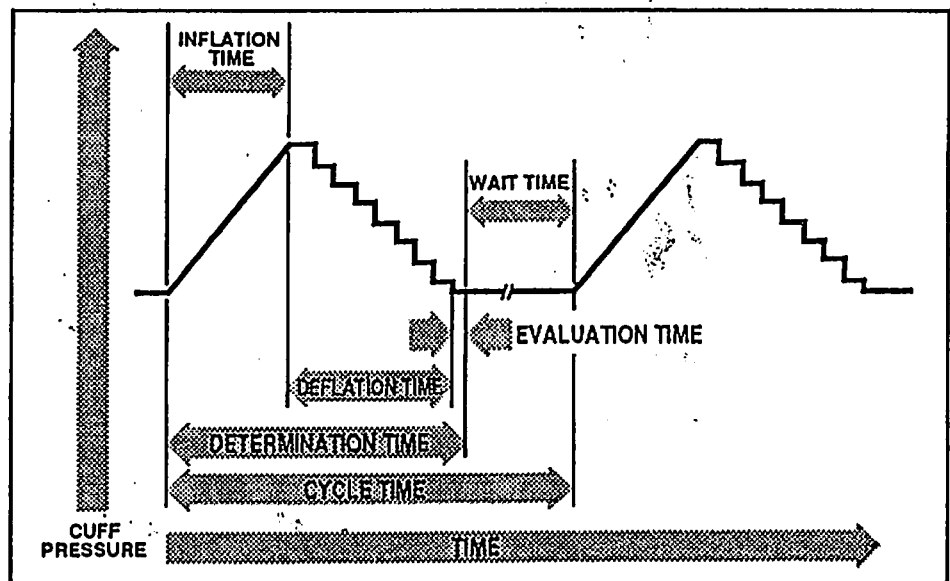


Figure 4-2. Basic Operating Cycle

OPERATING MODES

Manual Mode

The manual mode is entered automatically after a power-on keypress and is the normal mode of operation. Preset default alarm limits automatically activate at power on but these limits may be changed to suit any particular patient. (See Section 9, Alarms.) In the manual mode, a single determination is made each time and only when the START key is pressed.

Wait time is indefinite until the START key is pressed again.

The time elapsed since the last data update shows in the cycle minutes display area for a period up to 90 minutes. After 90 minutes, the NIBP display area is blanked.

A determination may be cancelled at any time by a CANCEL keypress. This action deflates the cuff, places the monitor in wait time, and leaves any operator-set alarm limits unaltered.

Alarm indicators can be cancelled (after a determination has caused an alarm condition) by pressing CANCEL. This action mutes the audible NIBP patient alarm and cancels NIBP visual alarm indicators and leaves operator-set alarm limits unaltered.

NOTE

Any momentary power interruption (blackout, brownout, or cycling of the power ON/OFF key) will cause the Monitor to revert to the mode prior to the interruption with the *preset* default alarm limits in effect regardless of the operation mode prior to interruption.

Auto Mode

Auto mode is entered by pressing the AUTO/MAN softkey in the NIBP Setup menu. In auto mode, the first determination is initiated immediately. If a patient alarm is detected, another determination is initiated to verify the alarm. Subsequent determinations occur at the expiration of the time displayed in the cycle minutes display area or at any time when the START key is pressed.

You may cancel a determination-in-progress at any time by pressing CANCEL. This action deflates the cuff and begins a new wait time (as seen in the cycle minutes display area). Any operator-set alarm limits are unaltered. If a determination has caused an alarm condition, alarm indicators can be cancelled by a CANCEL keypress. This action silences the NIBP audible patient alarm and cancels NIBP visual indicators, begins a new wait time, and leaves operator-set alarm limits unaltered.

Stat mode

Stat mode may be entered at any time by a STAT keypress. In stat mode, the monitor initiates a series of determinations for a 5-minute period. A determination begun before expiration of the 5-minute period will cycle to conclusion and the results will be displayed before the monitor reverts to the previous mode.

The series begins with cuff inflation to a pressure above previous systolic value or, if no previous systolic is stored, to approximately 170 mmHg for adult/pediatrics and approximately 120 mmHg for neonates. Artifact rejection is relaxed in stat mode for adult/pediatric patients to allow for accelerated determinations. In the stat mode, as the monitor begins stepdown, systolic pressure is displayed the instant that it is determined—usually a few seconds after stepdown begins. The monitor shows the 'early' systolic in reverse video. When MAP, pulse, and diastolic pressure values are determined, the monitor sounds a short tone—a beep—and the updated values appear in the NIBP display. The systolic value will be updated and cease to display in reverse video. After at least three (3) seconds at less than 40 mmHg, the monitor begins another determination unless the 5-minute period has ended or you have pressed the CANCEL key.

During stat mode audible patient alarms are muted but patient alarm limits can be accessed. The occurrence of an out-of-limits alarm will not be noted. At the end of the 5-minute stat mode period or after a CANCEL keypress, the monitor automatically reverts to the mode of operation prior to initiation of stat mode (manual or auto).

Subsequent Determinations

For the first determination, the monitor inflates the cuff to approximately 170 mmHg (120 mmHg if neonate). Thereafter, the monitor will 'adapt', choosing a cuff inflation pressure based on the results of the prior determination. Generally, the monitor will attempt to make its subsequent determination approximately 30 mmHg higher than the patient's systolic blood pressure (SBP) (20 mmHg if neonate). However, there are exceptions; they are:

- ☐ If the patient's SBP as measured by the previous determination was less than 30 mmHg or the monitor was unable to measure SBP, then the monitor will use the patient's MAP as a basis, and inflate the cuff to approximately 70 mmHg above the previous MAP (50 mmHg if neonate).
- ☐ If neither MAP nor systolic pressures have been successfully measured, but fewer than 120 seconds have passed since the last attempt, the monitor will inflate the cuff to approximately 200 mmHg (140 mmHg if neonate).
- ☐ If two (2) minutes or more pass with no successful determination, the monitor will revert to the initial cuff inflation target of 170 mmHg (120 mmHg if neonate).

The monitor will never inflate higher than 250 mmHg (220 mmHg for neonates).

For example, suppose the monitor is turned on and its cuff is attached to an adult patient whose blood pressure is 100/60, with a MAP of 75. The next determination's inflation pressure will be $(100 + 30)$, or 130 mmHg. If this next determination fails to measure SBP, but does successfully find a MAP of 82, the monitor's next inflation pressure will be $(82 + 70)$, or 152 mmHg.

The monitor continues to use a higher inflation pressure through subsequent determinations as the patient's systolic pressure falls. The unit will then lower inflation pressure accordingly.

Systolic Search

The monitor has two types of searches. One search can be called the 'big' search, which is described as follows.

In any operating mode, if a patient's systolic pressure should exceed the monitor's inflation pressure, the unit will

- ☐ begin normal deflation sequence,
- ☐ detect the absence of a systolic value,
- ☐ stop deflation,
- ☐ reinflate to a higher (than initial) inflation pressure (250 mmHg reinflate maximum), and
- ☐ resume normal deflation sequence.

This additional inflation will occur only once per determination.

The second search—the 'little' search—happens if there is a previous valid systolic pressure which is displayed. If the new systolic pressure oscillations are compared with the previous valid determination and the monitor 'thinks' that the systolic was not obtained, the monitor will inflate to a pressure of an additional 50 mmHg above the immediately preceding inflation. Again, this additional inflation will occur only once per determination.

UNDETERMINED SYSTOLIC AND DIASTOLIC PRESSURES

Under certain circumstances, the Monitor may display only MAP and not display values for systolic and diastolic pressures. If the patient is in shock, the systolic/diastolic waveform has very low amplitude fluctuations as shown in Figure 4-3, Low Amplitude Waveform Diagram.

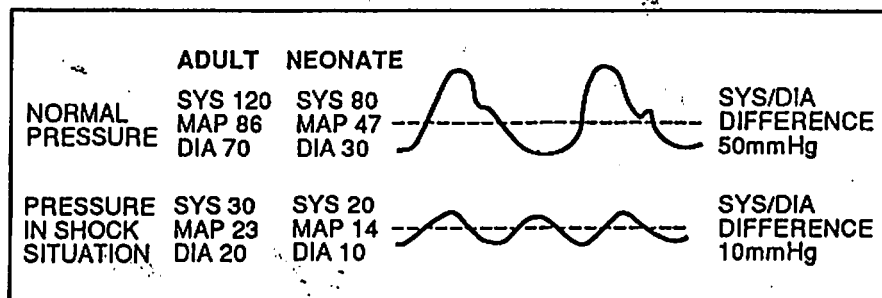


Figure 4-3. Low Amplitude Waveform Diagram

Because of the relative small difference between systolic and diastolic pressure in a shock situation, only MAP can be accurately determined and displayed. If this condition occurs while in auto mode, the Monitor will attempt one or more additional determinations after a 15-second delay.

INDICATIONS and CONTRAINDICATIONS

The DINAMAP™ PLUS Monitor is intended for noninvasive monitoring of blood pressure. This device is not designed, sold, or intended for use except as indicated.

OPERATING WARNINGS, PRECAUTIONS, and NOTES

WARNINGS

- ☐ The monitor will not measure NIBP effectively on patients who are experiencing convulsions or tremors.
- ☐ If a patient is encountering arrhythmias, this will increase the monitor's determination time and may even extend the blood pressure determination time to beyond the monitor's capabilities (120 seconds).
- ☐ The monitor displays results of the last blood pressure determination for 90 minutes or until another determination is completed. If a patient's condition changes during the time interval between determinations, the monitor will not detect the change or indicate an alarm condition.
- ☐ In some cases, rapid, prolonged cycling of a noninvasive blood pressure parameter has been associated with ischemia, purpura and/or neuropathy. It is recommended to apply the cuff appropriately and to check the cuff site and cuffed extremity regularly when monitoring at frequent intervals and/or over extended periods of time.
- ☐ Vital signs may very likely be inaccurate if you use cuffs, hoses, probes, sensors or accessories other than those recommended by Critikon, Inc.

PRECAUTIONS

- ☐ NIBP accuracy is dependent on the application of the proper size cuff and hose. It is essential that limb circumference be measured and the proper size cuff be selected. If the cuff is not at heart level, the difference in the reading due to the hydrostatic effect should be noted. The value of 1.80 mmHg must be added to the displayed readings for every inch above heart level. The value of 1.80 mmHg must be subtracted from the displayed readings for every inch below heart level.
- ☐ The pulse rate displayed by the monitor may differ from the heart rate displayed by an ECG monitor because the monitor measures actual peripheral pulses, not electrical signals or contractions from the heart. Occasionally, electrical signals at the heart do not produce a peripheral pulse. Similarly, if a patient's beat-to-beat pulse amplitude varies significantly (for example, *pulsus alternans*, atrial fibrillation, rapid cycling artificial ventilator), blood pressure and pulse rate readings can be erratic and an alternate measuring method should be used for confirmation.
- ☐ Observe the patient's cuffed extremity for signs of impeded blood flow when monitoring NIBP at frequent intervals.

NOTE

- ☐ A patient's vital signs may vary dramatically during the application of agents affecting the cardiovascular status such as those used to raise or lower blood pressure or raise or lower heart rate.

**HOW TO CONNECT
THE HOSES**

Connect the pneumatic hoses to the monitor at the front panel. There is no preferred order of connection; either hose connector may be attached to either port. Thread the hose connectors onto monitor ports until finger-tight. **DO NOT OVERTIGHTEN.** The pneumatic seal is not made by tightening the connector.

HOW TO SELECT PROPER SIZE CUFF and CUFF PLACEMENT

WARNING

Do not place the cuff on an extremity being used for intravenous infusion, or any area where circulation is compromised or has the potential to be compromised.

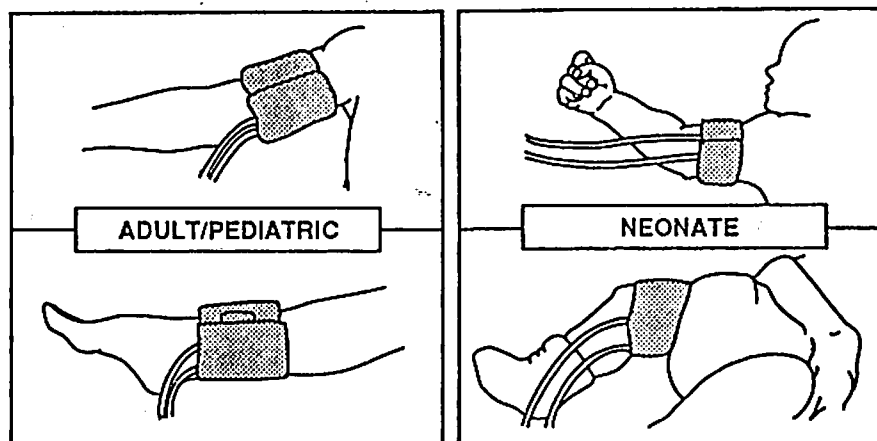


Figure 4-4. Blood Pressure Recommended Cuff Placement

TABLE 4-2. CUFF-TO-HOSE COMPATIBILITY

CUFF TYPE	CUFF SIZE LIMB CIRCUMFERENCE	CUFF REORDER NO.	HOSE LENGTH	HOSE NO.
Neonate #1	3 cm—6 cm	8311	8 ft.	8840
Neonate #2	4 cm—8 cm	8312	8 ft.	8840
Neonate #3	6 cm—11 cm	8313	8 ft.	8840
Neonate #4	7 cm—13 cm	8314	8 ft.	8840
Neonate #5	8 cm—15 cm	2619	8 ft.	8840
Infant	8 cm—13 cm	2783	12 or 24 ft.	8841/8842
Child	12 cm—19 cm	2781	12 or 24 ft.	8841/8842
Small Adult	17 cm—25 cm	2779	12 or 24 ft.	8841/8842
Adult	23 cm—33 cm	2774	12 or 24 ft.	8841/8842
Large Adult	31 cm—40 cm	2791	12 or 24 ft.	8841/8842
Thigh	38 cm—50 cm	2796	12 or 24 ft.	8841/8842

WARNING

It is mandatory that the 8-foot hose (Reorder No. 8840) be used with neonatal cuffs and the 12- or 24-foot hose (Reorder No. 8841/8842) be used with infant through thigh cuffs. Any attempt to modify hoses will inhibit the monitor from switching to the proper mode.

1. Select the appropriate blood pressure measurement site. For neonates, the arm or leg can be used. For adults/pediatrics, the preferred cuff location is the arm. When the arm cannot be used, placement on the ankle is preferred over the thigh since measurement on the adult thigh may be uncomfortable. When there is no suitable alternative for the thigh (for example, shock), set the monitor's (NIBP) determination cycle to five (5) minutes or longer, unless the clinical situation requires more frequent measurement. See Figure 4-4.
2. Measure the patient's limb and select the proper size cuff according to the size marked on the cuff or cuff package. The monitor's accuracy depends on use of the appropriate cuff and hose. Too small a cuff will give a false high reading while too large a cuff will give a false low reading. Refer to Table 4-2.
3. Connect the cuff to the pneumatic hoses.
4. Squeeze all the air from the cuff.

WARNING

Excessive tightness will cause venous congestion and discoloration of the limb, but too loose a cuff may result in no readings and/or inaccurate readings.

5. Place the cuff snugly on the patient. In the case of upper arm placement, it is recommended to place the cuff as proximally as possible. Observe the mark on the inside of the cuff to be placed over the artery. Be sure the cuff is snug, but not so tight as to prevent venous return between determinations.
6. If it becomes necessary to change the cuff to another limb, make sure the appropriate size cuff is used.

PRECAUTION

To obtain accurate determinations, extremity and cuff motion must be minimized.

HOW TO INITIATE A NONINVASIVE BP DETERMINATION

NIBP operates in manual, auto, or stat modes. Modes are indicated by MANUAL, AUTO, and STAT in the NIBP display area. The time elapsed since the last determination follows the mode 'name' and is enclosed in parentheses. Cycle time is shown only during auto mode; it is displayed following 'AUTO'.

The heart rate appears in the upper right corner of the screen; the rate source is indicated below the rate. See Figure 4-5 and Figure 4-6.

Heart Rate/ Pulse Priority	
1	ECG
2	PRESS1
3	PRESS2
4	SpO2
5	NIBP

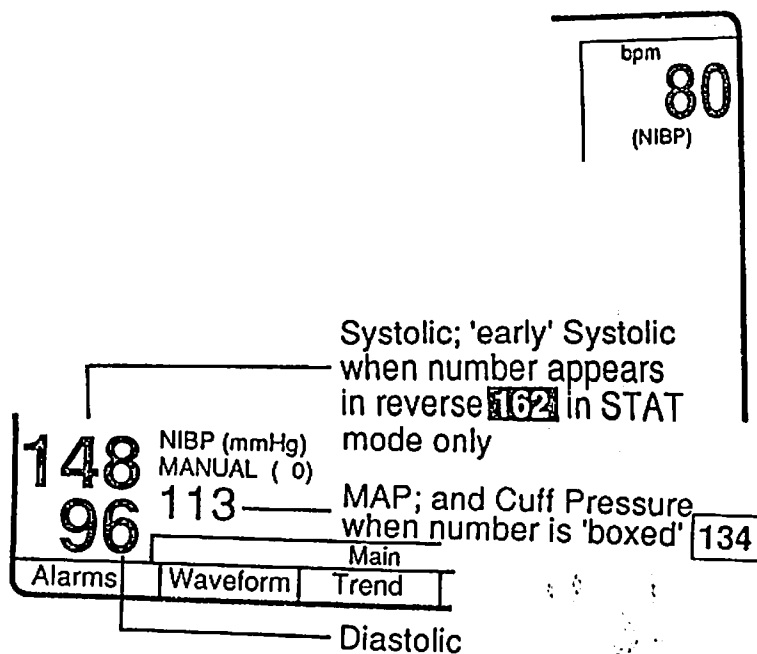


Figure 4-5. NIBP Field in Manual Mode in Main Menu

Refer to Section 3, Waveform (Format/Large Number Display) for the option to display large numbers for NIBP data.

Manual Mode

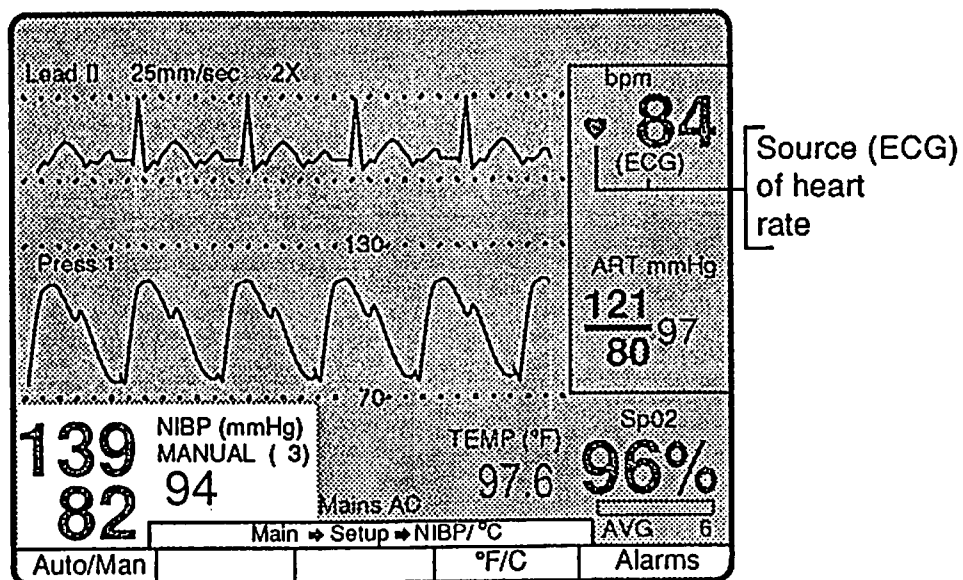


Figure 4-6. Manual Mode with NIBP Setup Menu

To operate the noninvasive blood pressure parameter in manual mode, follow these procedures.

1. Press power ON, if necessary. After the power on display screen, the main menu displays. If the monitor is already powered on, a START keypress is all that is necessary.
2. Press START to begin each determination in manual mode. During a determination, the cuff pressure is 'boxed' in the MAP field.

The determination results will display for 90 minutes after which time dashes (— —) will replace the numbers.

After the first determination, change the preset alarm limits if desired via the Alarms menu. Based on the patient's current reading, you can change the limits automatically (Auto Set) or change limits manually.

MAIN
MENU

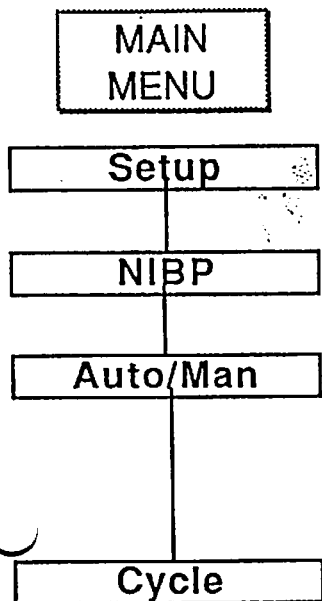
START

Alarms

Auto Mode

To operate the noninvasive blood pressure parameter in auto mode, follow these procedures.

1. Press power ON, if necessary. After the power on display screen, the main menu displays.
2. Press Setup.
3. Press NIBP.
4. Press Auto to enter auto mode. The keypress immediately initiates the first determination in auto mode and 'Cycle' appears in the soft key label bar. The Auto/Man key toggles between auto and manual mode.
5. The preset cycle time for auto mode is 3 minutes, which is the number following 'AUTO'. To change the cycle time, press Cycle until the desired time appears in the display. Each keypress increments the minutes time from 1, 2, 3, 4, 5, 10, 15, 20, 30, 45, 60, 90, 1, 2 minutes, and so on. If 3 seconds go by without a keypress, the time starts at 1.



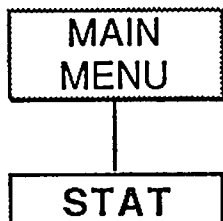
PRECAUTION

The monitor should be set to cycle only as frequently as is necessary to ensure adequate patient monitoring.

If the monitor powers on in Auto mode, the first determination will not occur until after the expiration of cycle time. If a determination is desired immediately, press the START key.

After the first determination, change the preset alarm limits if desired via the Alarms menu. Based on the patient's current reading, you can change the limits automatically (Auto Set) or change limits manually.

Alarms



Stat Mode

To operate in stat mode, follow this procedure.

1. Press power ON, if necessary.
2. Press STAT to start a 5-minute period of continuous determinations. After each determination, the cuff is deflated to allow for venous return. The cuff pressure is 'boxed' and after the first determination, the 'early' systolic appears in reverse video during the determination.

During stat mode, if any patient alarm limits are exceeded, the audible alarms will not sound nor will the displays flash (for NIBP only). The determinations will continue until the 5-minute period is completed.

The occurrence of a procedural alarm will not inhibit the series of determinations or display of values. Stat mode may be entered from manual or auto mode at any time.

CANCEL

3. After five (5) minutes or whenever CANCEL switch is pressed, the monitor will return to the previous operating mode. If the previous mode was auto, a new wait cycle will start. The NIBP parameter will not initiate a determination immediately after reentering auto mode from stat mode.

HOW TO STOP A DETERMINATION

CANCEL

Cancel

Press CANCEL to stop a determination-in-progress and to deflate cuff.

ALARMS

Alarms

Alarm preset default values are for convenience only; preset or default values are not intended for all clinical situations. To change/set the systolic, MAP, pulse, and diastolic alarm limits, enter the Alarms menu by an Alarms keypress. Refer to Section 9, Alarms.

TABLE 4-3. NIBP ALARMS—PRESET and RANGE

	Preset		Range	
	Low	High	Low	High
Systolic*	30	180	30—150	75—245
Mean, Adult*	50	140	20—120	70—225
Neonatal	30	100	20—120	70—225
Diastolic*	15	130	10—120	50—210

*Auto Set: Based on the current reading, less 20% for low and plus 20% for high

NOTE

Default alarm limits are found useful generally in normal clinical situations. They should not be considered as safe limits for any particular patient.

TABLE 4-4. NIBP MONITORING

NIBP Monitoring		
	Action	Result
8710 or 8720	START Key: Each Start keypress...	...starts an NIBP determination.
8710 or 8720	AUTO/MAN Key: Each Auto/Man keypress... In Auto mode... If Auto mode is in effect at power off, In Manual mode...	...toggles between Auto and Manual mode. ...a determination is made on entry and automatically every X minutes based on cycle time. ...the monitor 'remembers' and Auto mode is in effect at subsequent power on. ...a determination is initiated only with a Start keypress.
8710 or 8720	CYCLE Key: A Cycle (present only if in auto mode) keypress...	...causes an increment in minutes time.
8710 or 8720	STAT Key: A Stat keypress...	...causes a 5-minute period of continuous determinations.
8710 or 8720	CANCEL Key: A Cancel keypress...	...stops a determination-in-progress and deflates cuff. Monitor returns to previous operating mode.

NIBP CALIBRATION

Calibration of the monitor should be checked every 12 months, or when there is doubt about the validity of the noninvasive blood pressure readings. Calibration should be performed by qualified service personnel. The exchange or replacement of a system processor board or analog board requires recalibration of the NIBP.

NIBP SPECIFICATIONS

CUFF PRESSURE RANGE

Adult/Pediatric	0 mmHg to 250 mmHg
Neonate	0 mmHg to 220 mmHg

INITIAL CUFF INFLATION

Adult/Pediatric	170 mmHg $\pm$ 15 mmHg
Neonate	125 mmHg $\pm$ 15 mmHg

MAP DETERMINATION

Adult/Pediatric	(Maximum)	225 mmHg
	(Minimum)	20 mmHg
Neonate	(Maximum)	170 mmHg
	(Minimum)	20 mmHg

SYSTOLIC DETERMINATION

Adult/Pediatric	(Maximum)	245 mmHg
	(Minimum)	30 mmHg
Neonate	(Maximum)	190 mmHg
	(Minimum)	30 mmHg

DIASTOLIC DETERMINATION

Adult/Pediatric	(Maximum)	210 mmHg
	(Minimum)	10 mmHg
Neonate	Maximum)	160 mmHg
	(Minimum)	10 mmHg

DETERMINATION TIME

Manual/Auto: 20 seconds to 45 seconds typical;
120 seconds maximum

Stat: 19 seconds typical; at nominal blood pressure and heart rate

OVERPRESSURE CUTOFF

Adult/Pediatric 300 mmHg +30/-48 mmHg

Neonate 235 mmHg $\pm$ 10 mmHg**PULSE RATE RANGE**

Adult/Pediatric (Maximum) 200 bpm

(Minimum) 40 bpm

Neonate (Maximum) 220 bpm

(Minimum) 40 bpm

PULSE RATE ACCURACY ($\pm$ one standard deviation [68% of all readings]) $\pm$ 3.5 percent**PRESSURE DISPLAY ACCURACY** $\pm$ 3mmHg**ACCESSORIES**

Standard	Part No.
1 Cuff, DURA-CUF™ Bladderless, Adult	2774
1 Pneumatic Hose with Connectors 12 ft. Adult/Pediatric (Blue)	8841
1 Calibration Kit	320-246

Section 5. Pulse Oximetry (SpO₂)

DESCRIPTION

The DINAMAP™ *PLUS* Monitor is designed to noninvasively monitor oxygen saturation. The pulse oximetry parameter automatically measures oxygen saturation of arterial blood for adult/pediatric and neonate patients. Results are shown on the front panel display. The operator may select the average interval.

The pulse oximeter parameter provides continuous readings of oxygen saturation and pulse rate*. The oxygen saturation is displayed in the SpO₂ Data Field and the pulse rate—when derived from the oximetry parameter—is displayed in the Heart Rate/Pulse Data Field. The pulse oximeter data field displays a signal strength bar graph and gives audio beeps with each pulse at the requested pulse (QRS) volume. Visually, the signal goes left to right on the bar graph depending on the strength of the signal; with increasing strength a larger area is covered. The frequency of the audible pulse tone will rise and fall with the percent of saturation. The higher the saturation, the higher the frequency of the pulse tone. To operate the pulse oximeter, follow these instructions.

PULSE OXIMETER DETERMINATION SEQUENCE

Pulse oximeter determinations are continuous; in the operate mode, determinations begin after the system and sensor cable is connected to the monitor and the sensor is placed on the patient.

Saturation determinations are taken noninvasively. As light emitted by the sensor passes through the monitored site, measurements are taken of the change in relative transmission of infrared and red light through the tissue. These values are then transformed to correspond to hemoglobin saturation.

The saturation value is averaged over the average interval in seconds and then is shown in the front panel display labeled SpO₂. If the heart rate is derived from the oximeter, that is (SpO₂), the rate is averaged over the averaging interval in beats.

* If pulse is not determined from ECG, or IP

The signal display bar graph indicates the signal strength of the infrared or red signal, whichever is greater.

Average Interval (Avg Int)

The Avg Int (Average Interval) soft key allows you to make a choice of the number used to derive the average oxygen saturation/rate value displays. For saturation, the averaging is in seconds and for rate, the averaging is in beats only if the Average Interval is set at "0". The oxygen saturation/rate display is updated at each second or pulse beat. The preset average interval number is 6.

INDICATIONS and CONTRAINDICATIONS

The DINAMAP™ PLUS Monitor is intended for noninvasive monitoring of oxygen saturation. This device is not designed, sold, or intended for use except as indicated.

OPERATING WARNINGS, PRECAUTIONS, CAUTIONS, and NOTES

WARNINGS

- ☐ Do not use the monitor or SpO2 sensor in the presence of magnetic resonance imaging (MRI) devices. There have been reports of sensors causing patient burns when operating in an MRI environment.
- ☐ Failure to apply the sensors properly may cause incorrect measurements of oxygen saturation or alter skin integrity.
- ☐ Do not use a damaged sensor or one that has exposed electrical contacts.
- ☐ Cardio-green and other intravascular dyes may, depending on concentration, affect the accuracy of the measurement.
- ☐ Excessive pressure from the oximeter sensor may cause pressure necrosis.
- ☐ When a sensor is on the same limb with an inflated blood pressure cuff, valid data will not be received when the cuff is inflated. Attach sensor to the limb opposite the site used for the blood pressure cuff if saturation readings are required throughout the entire blood pressure determination.
- ☐ Accuracy may be affected when sensor is placed on polished or artificial nail.

WARNINGS Continued

- ☐ The pulse oximeter parameter is calibrated to read arterial oxygen saturation. Significant levels of dysfunctional hemoglobins such as carboxyhemoglobin or methemoglobin may affect oxygen saturation measurement.
- ☐ Vital signs may very likely be inaccurate and patient injury may result if you use sensors or accessories other than those recommended by Critikon, Inc.
- ☐ The clip-on sensor should never be taped shut; taping the sensor may alter skin integrity or cause impaired venous return, resulting in venous pulsation and inaccurate saturation measurements.

PRECAUTIONS

- ☐ Do not perform any testing or maintenance on a sensor while it is being used to monitor a patient.
- ☐ Placement of a sensor distal to an arterial line may interfere with the detection of an adequate arterial pulsation to determine the oxygen saturation value.
- ☐ Observe the oximeter sensor site to assure circulation distal to the sensor.
- ☐ It is important that the sensor be positioned so that the LED (light emitting diode) and photodiode are opposite one another.
- ☐ For best sensor performance, the sensor should be placed at heart level.
- ☐ Bright light sources (for example, infrared heaters, bilirubin lights, direct sunlight, operating room lights) may interfere with the performance of the pulse oximeter. This can be prevented by covering the sensor with opaque material.
- ☐ Patient motion can affect sensor performance. Replacing the sensor to assure good adhesion or changing the sensor site may reduce motion artifact.

PRECAUTIONS Continued

- ☐ Do not place any SpO2 clip-on sensor in patient's mouth, or on nose or toe.
- ☐ Do not place clip-on finger sensor on patient's thumb, or across a child's foot or hand.
- ☐ As with any clip-on sensor, pressure is exerted. The clinician should be cautious in using a clip-on sensor on patients with compromised circulation (for example, peripheral vascular disease, patients receiving vaso-constricting medications).
- ☐ During a blood pressure determination the oximeter alarms will be disabled.

CAUTIONS

- ☐ Do not sterilize sensors.
- ☐ When handling the sensor, do not scratch the sensor's clear optical surfaces or strain the sensor cable.

NOTES

- ☐ If SpO2 derived pulse is erratic, the pulse oximeter parameter may be unable to measure pulse and cause an alarm.
- ☐ A patient's vital signs may vary dramatically during the application of agents affecting the cardiovascular status such as those used to raise or lower blood pressure or raise or lower heart rate.
- ☐ If a valid SpO2 signal was present but disappears while an NIBP determination is in progress, an alarm message "P55-SPO2 NO SIGNAL" appears onscreen but the audible alarm will not sound. After 15 seconds or completion of an NIBP determination, if the SpO2 signal still is not present, the audible alarm sounds.

HOW TO CONNECT THE SENSOR

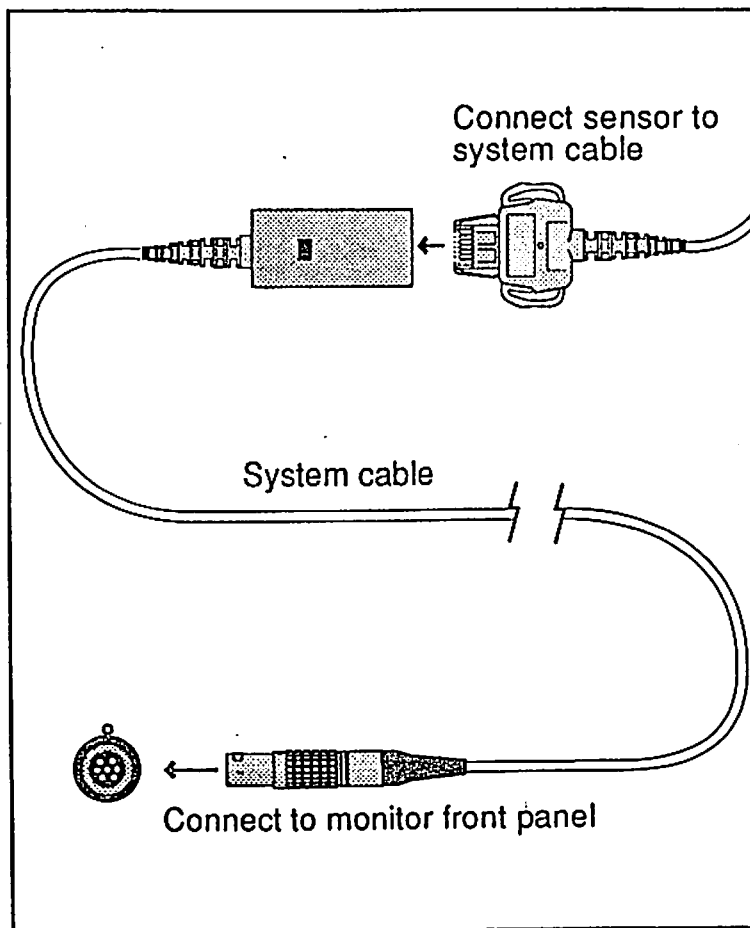


Figure 5-1. Sensor to System Cable to Monitor Connection

1. Connect the finger sensor cable to the sensor (system) cable.
2. The sensor (system) cable receptacle port is located in the front panel, the lower left side as you face the monitor. Match the red dot on the top of the connector to the dot imprinted on the front panel to insert the connector.

HOW TO DISCONNECT THE SENSOR

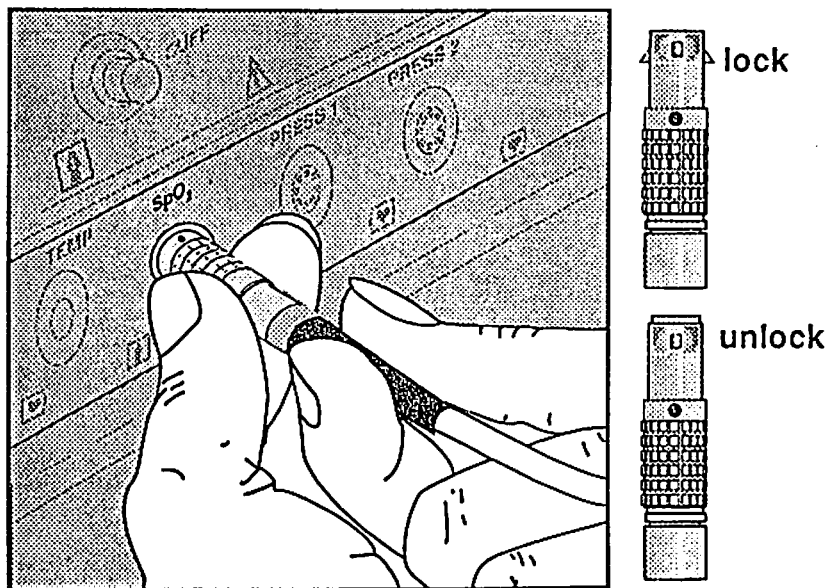


Figure 5-2. Sensor Disconnect

1. To ensure that you do not break or cause undue strain on the sensor (system) cable, follow these directions to disconnect the connector from the front panel. Grasp the knurled shell ring with thumb and index finger. Pull back on knurled shell to *unlock* the connector.

NOTE

Some SpO2 cables may have a molded connector and do not lock.

HOW TO APPLY THE CLIP-ON FINGER SENSOR

WARNING

Do not allow the fingertip to press against the finger stop at the distal end of the sensor and the skin to pinch between side walls of the clip-on sensor.

PRECAUTION

The clip-on finger sensor must be removed every hour or more often if clinically indicated, to check skin integrity, circulatory status, and correct alignment.

1. Open the clip-on finger sensor housing. With the patient's hand palm down, place any finger except the thumb over the sensor detector and LED. The cable should be on the top of the finger.
2. Make sure the fingertip is not pressed against the edge of the finger stop at the distal end of the sensor. If the patient has long nails, the nail tip can extend over the finger stop.

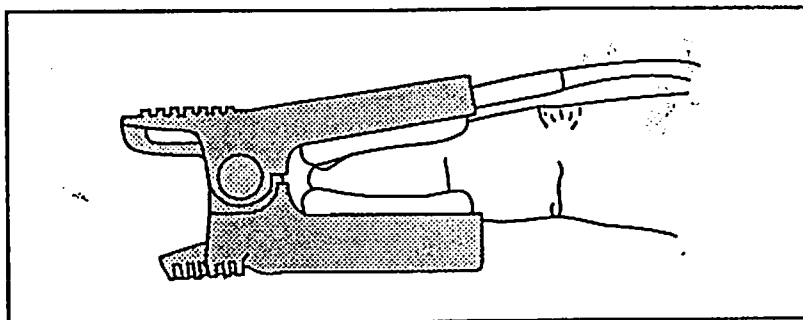


Figure 5-3. Finger Sensor

3. Slowly release the clip-on housing, making sure the sides of the fingers are not being pinched. If the finger is being pinched, move the clip-on sensor to a smaller finger.

HOW TO MONITOR SpO2

Power On

The pulse oximeter is in the standby ('off') mode at power on as the unit arrives from the factory. This factory preset mode may be changed (by biomedical personnel) to power on in operate mode. Standby mode is indicated in the SpO2 data field by "Standby". If in operate mode, the average interval and bar graph are located in the data field, underneath the percent of oxygen saturation. If Pleth is selected, the plethysmographic waveform appears in either waveform field 2 or 3, depending on whether another waveform besides ECG is present. See Figure 5-4.

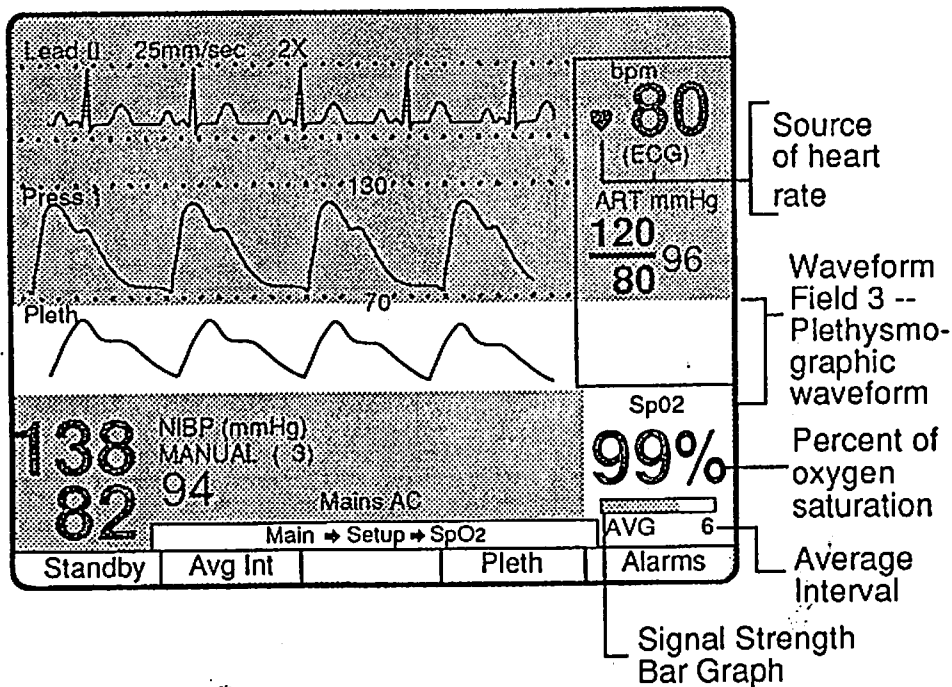


Figure 5-4. SpO2 Data Field (Normal Size Numbers) and Waveform Field 3 in the SpO2 Setup Menu

There is an option to display SpO2 data in large-size numbers; refer to Section 3, Waveform (Format/Large Number Display). If large-size numbers are displayed at power off, the monitor 'remembers' and at the subsequent power on, large-size numbers again are displayed.

To monitor oxygen saturation enter the Setup menu for SpO₂ and press the Standby key, if necessary, to put SpO₂ in operate mode.

If in operate mode a "P55-SPO2 NO SIGNAL" alarm occurs during an NIBP determination, the audible indication is delayed because an inflated cuff may occlude arterial pulsations if cuff and sensor are on the same limb. If the P55 alarm condition persists for more than 15 seconds, the audible alarm sounds. If a P55 alarm occurs when a NIBP determination is not in progress, the audible alarm sounds. Check the patient and the sensor; reposition sensor.

MAIN
MENU

Setup

SpO₂

Standby

Avg Int

1. Press power ON, if necessary. The Main Menu will appear after the power on display screen.
2. To enter operate mode or to make any changes in the individual factors in SpO₂ monitoring, enter the Setup menu. Press Setup.
3. Press SpO₂. The SpO₂ Setup menu gives you access to change the mode, average interval, pleth waveform, and alarms. When in standby mode, the Avg Int and Pleth keys disappear from the soft key menu label bar.

The SpO₂ Setup menu soft keys are described below.

Standby

A Standby keypress changes the mode from operate to standby or from standby to operate.

Average Interval

An Avg Int keypress changes the number of seconds/beats used by the oximeter to derive the average value displayed in the SpO₂ data field. The preset value is 6. The average interval is selectable from 0 to 30 in steps of 3.

Subsequent Avg Int keypresses cycle through the values.

Pleth**Pleth Waveform**

The Pleth soft key enables you to show the plethysmographic waveform or to remove the waveform from the display screen. If the unit does not monitor invasive pressure, the pleth waveform displays in waveform field 2.

If only one invasive pressure channel (PRESS1 or PRESS2) is active, the plethysmographic waveform will display in waveform field 3. If both invasive pressure channels PRESS1 and PRESS2 are active, the plethysmographic waveform will not show on the screen. However, you can reorder the priority in waveform field 3 by a Pleth keypress. Press Pleth to display the waveform. (Press Pleth again to return to pressure monitoring.)

Alarms**Alarms**

Alarm preset default values are for convenience only; preset or default values are not intended for all clinical situations. An Alarms keypress takes you to the Alarms menu where you are able to change the limits. The preset limits are a low of 90 and a high of 99. Auto set is an alarm setting using an algorithm based on the patient's current condition to establish alarm boundaries. Refer to Section 9, Alarms.

TABLE 5-1. SpO2 ALARMS—PRESET and RANGE

	Preset		Range	
	Low	High	Low	High
Saturation	90	99	40—95	90—99
Auto Set:	Low Limit: Current reading less 5			
	High Limit is fixed at 99			

TABLE 5-2. SpO₂ MONITORING

SpO ₂ Monitoring		
	Action	Result
8710 or 8720	SpO₂ Key: In the Setup menu, an SpO ₂ keypress...	...causes entry into the SpO ₂ Setup menu.
8710 or 8720	Standby Key: Each Standby keypress... In standby mode... In operate mode...	...toggles between operate and standby mode. ...no measurements are made. ...oxygen saturation and pulse measurements are made continuously.
8710 or 8720	Avg Int Key (present only if in operate mode): An Avg Int keypress...	...causes an increment in number of seconds/ beats used to derive average value displayed.
8710 or 8720	Pleth Key (present only if in operate mode): A Pleth keypress... Each Pleth keypress...	...causes a plethysmographic waveform to display. A Pleth keypress overwrites IP2 if active in waveform field 3. ...enables or removes the pleth waveform from the display.
8710 or 8720	Alarms Key: An Alarms keypress...	...causes entry to the Alarms menu.
8710 or 8720	SILENCE Key: An SILENCE key-press in a P00-SpO ₂ DISCONNECTED alarm situation...	...clears the alarm.

CALIBRATION

No calibration is required for the pulse oximeter parameter. Calibration is checked automatically at power up by the monitor's system.

SpO2 SPECIFICATIONS

Performance

OXYGEN SATURATION ACCURACY ($\pm$ one standard deviation [68% of all readings])

Adult

90% - 99% $\pm$ 2.0%

75% - 89% $\pm$ 3.0%

Under 75% - unspecified

Neonate

90% - 99% $\pm$ 2.0%

Under 90% - unspecified

PULSE RATE DETERMINATION

30 bpm - 250 bpm

PULSE RATE ACCURACY ($\pm$ one standard deviation [68% of all readings])
 $\pm$ 3.5 percent

SATURATION PITCH INDICATOR

Pitch changes with saturation.

Volume selectable from 0 (off) to 15.

Waveforms

The pulse plethysmograph (PPG) waveform is derived from the IR (Infrared) signal.

ACCESSORIES

Standard

Adult Clip-on Finger Sensor
(Sensor) System
cable, 10 ft.

Reorder No.

9084

8731

Section 6. ECG Monitoring

DESCRIPTION

The DINAMAP™ *PLUS* Vital Signs Monitor will derive and display ECG Lead I, II, or III waveforms and heart rate for neonates, children, or adults. The waveform can be displayed at any one of three sweep speeds (12.5 mm, 25 mm, or 50 mm per second). The monitor provides an audible and visual indication of bradycardia or tachycardia as defined by user selectable high and low heart rate alarm limits. The monitor will also display a "Lead Off" message and sound an audible alarm to alert the operator should the electrodes, leads, cables, or their connectors lose electrical continuity.

ECG MONITORING FEATURES

- ☐ Can be used to monitor neonates, children, or adults
- ☐ Displays heart rate in beats per minute derived from ECG waveform
- ☐ Displays waveform for any one of three separate leads (I, II, or III). Leads can be changed without changing electrode sites.
- ☐ Displays leads at any one of three sweep speeds (12.5 mm/sec, 25 mm/sec, or 50 mm/sec)
- ☐ Freezes and displays 6.0 seconds of the ECG waveform when selected by the user
- ☐ Alerts the operator to asystole, bradycardia or tachycardia as defined by user selectable limits
- ☐ Alerts the operator to LEAD OFF conditions
- ☐ Displays tabular trends for heart rate

INDICATIONS and CONTRAINDICATIONS

The ECG feature of the DINAMAP™ *PLUS* Vital Signs Monitor is indicated for use in obtaining electrocardiographic waveforms and heart rate. The device is not designed, sold, or intended for use except as indicated.

**OPERATING
WARNINGS,
CAUTIONS, and
NOTES**

WARNING

- ☐ Ensure that all equipment using high-intensity radio frequencies (for example, an electrosurgical unit) is properly grounded to reduce risk of inducing current into cables and electrodes which may interfere with the ECG signal, cause burns to the patient, inaccurate readings, and/or damage to the monitor. Minimize this risk by operating the unit on battery power, using large electrosurgical pads, and placing ECG electrodes as far from radio frequency circuits as possible.

CAUTIONS

- ☐ Use only electrode wires, cables, and electrodes recommended by Critikon. Failure to use authorized accessories may result in inaccurate readings.
- ☐ Inspect to ensure that all cables, lead wires, and connectors are not damaged or significantly worn before using.
- ☐ Check expiration date of electrodes before applying to patient.

NOTES

- ☐ The hierarchy for source of heart rate value is as follows: ECG, IP (Press1 or Press2), SpO₂, and finally NIBP.
- ☐ Under some conditions, a cardiac pacemaker signal, in the absence of an accompanying QRS signal, may be interpreted as a QRS signal.
- ☐ Note that T waves that are greater than 120% of the amplitude of the QRS may be counted as pulses.
- ☐ Large surface potentials such as those encountered with external (transcutaneous) pacing may result in an inability to print ECG waveforms. This may be corrected by reducing the ECG scale to X/2.
- ☐ Pacer spikes are not removed from the ECG waveform. Reducing the ECG scale to X/2 should differentiate the pacer spike from the QRS complex.

**SELECT ECG
ELECTRODE SITE**

The typical and alternate sites for electrode placement for long term patient monitoring are shown in Figure 6-1.

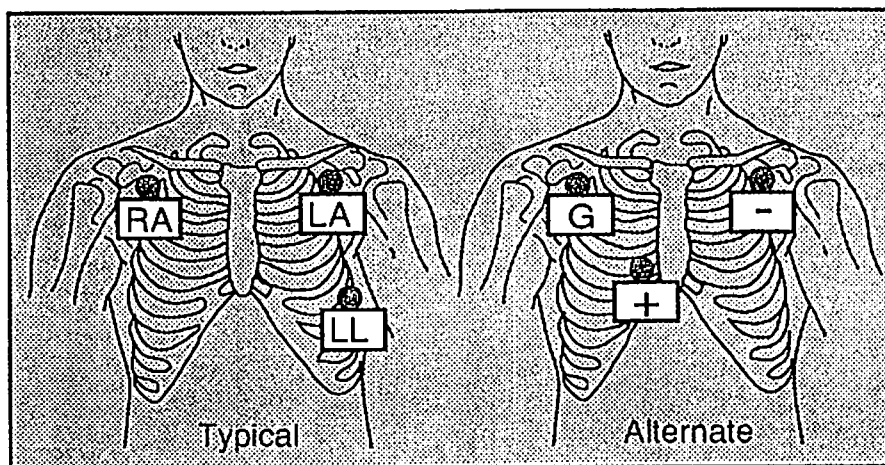


Figure 6-1. Typical and Alternate Electrode Sites

1. Select electrode sites.
2. Prepare each electrode site. Shave to remove hair if necessary. If patient is wet or perspiring, dry area with towel.
3. Clean all electrode sites with alcohol to remove skin oils and let air dry.
4. Attach patient lead wires to each patient electrode snap.

**HOW TO APPLY ECG
ELECTRODES TO
PATIENT**

1. Use only standard silver-silver chloride (Ag-AgCl) ECG electrodes (for example, 3M or Andover Medical) and follow all application instructions provided by the electrode manufacturer for long-term patient monitoring.
2. Press firmly to ensure good patient contact.

Note

Ensure that an adequate amount of pliable gel is present when using pregelled electrodes. When using nongelled electrodes, apply a 1/4 to 1/2 inch dollop over the entire contact area.

Appendix A. Printing Specific to Model 8726

DESCRIPTION

The Model 8726 Printer Module is an optional module designed for use with the DINAMAP™ *PLUS* Monitor Models 8710 series and 8720 series. This module adds two features to the monitor: battery operation and data recording. The printer, when connected to the monitor, will print a record of the monitor's measurements and waveforms.

The Model 8726 incorporates two battery slots with user-replaceable batteries and a thermal printer. The installed batteries perform the same function as the batteries in the Model 8725 Battery Module, that is battery operation of the monitor. Two buttons control the function of the thermal printer:

"Continuous"  and "Snapshot" 

OPERATING FEATURES

The Printer Module is designed to operate with DINAMAP™ *PLUS* Monitor Models 8710 and 8720 software revision RBB or later. Operating features are listed.

- ☐ Continuous and snapshot waveform print options
- ☐ Can be set to print automatically a parameter alarm condition
- ☐ Tabular trend print option
- ☐ Can select one or two waveforms to print
- ☐ Print frozen ECG
- ☐ All records are date- and time-annotated
- ☐ Easy-to-use printer setup menu for option selection
- ☐ Two rechargeable batteries that allow monitor operation and printing when AC power is not available.
- ☐ Easy paper replacement

CONTROLS and INDICATORS

The Printer Module front panel controls are described in Figure A-1, Printer Module 8726 Front Panel Controls.

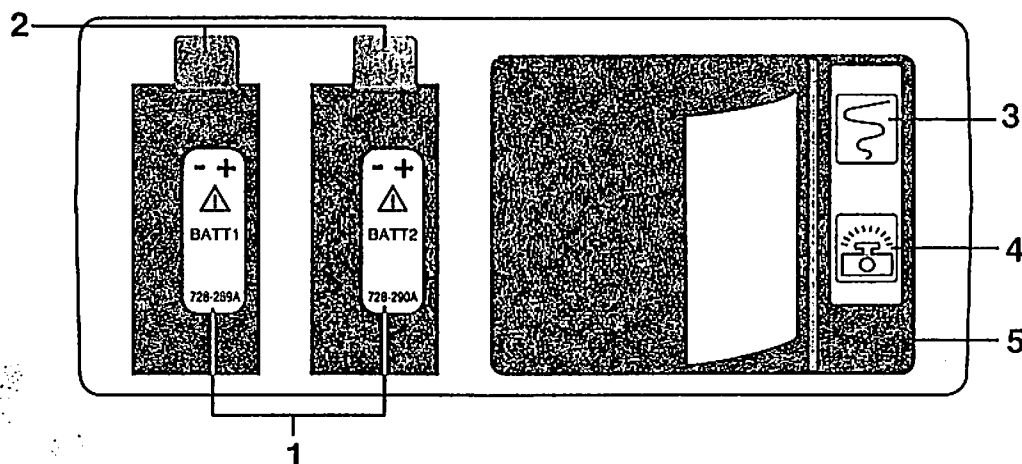


Figure A-1. Printer Module 8726 Front Panel Controls

TABLE A-1. FRONT PANEL CONTROLS

ITEM	NAME	FUNCTION
1	Battery Doors	Battery doors cover the opening into which each battery is to be inserted. The polarity for proper battery insertion is listed on the battery label (on the door). When a battery is inserted into the opening, the battery doors are not seen.
2	Release	Slide this red release to the right to eject the battery.
3	 Continuous key	Press this key to print waveforms or trends 'forever', that is continuously. Continuous printing has priority over any other printing. Press this key again to stop printing.
4	 Snapshot key	Press this key to print a minimum of 26 seconds of waveforms. Press the Continuous key twice to stop a snapshot printout.
5	Door Latch	Press this latch to open door to remove or replace thermal printer paper roll.

INSTALLATION

Unpacking and Inspection

The printer is shipped in a protective container. Visually inspect the container and the printer for damage. Retain all shipping materials for inspection by the carrier if shipping damage has occurred, or for returning the printer to Critikon. Contact Critikon Customer Support (refer to card in the back of the book) for return authorization procedures. If no apparent damage exists, the printer is ready for the initial setup procedure.

Connection

WARNING

**DO NOT CONNECT THE PRINTER
MODULE WITH THE MONITOR
POWERED ON.**

For information about connecting the module to the Monitor, refer to the instruction sheet provided with the module.

Initial Setup

The printer is shipped with two rolls of thermal paper. The paper must be installed prior to operation. The initial setup procedure verifies two specific functions:

- ☐ that the printer has no internal shipping damage, and
- ☐ that the printer is functional.

This verification should be done by qualified service personnel who will connect the printer to the monitor and who will perform a diagnostic print test to ensure the printer is working properly.

Power On

At power on, the monitor establishes communications with the printer. The power for the printer is provided by the monitor unless the unit is operating on battery power. If there is an internal printer problem, a message

R97 PRINTER ERROR

is displayed on the screen indicating that the monitor is unable to communicate with the printer. If this message occurs, return the unit to qualified service personnel. A Silence keypress clears the R97 alarm.

THERMAL PAPER

Instructions on Storage

Store thermal paper in a cool, dry place. The imaged record (thermal recording) should not be

- ☐ exposed to direct sunlight;
- ☐ temperatures over 100°F/38°C,
- ☐ relative humidities over 80%,
- ☐ or placed in contact with adhesives, adhesive tapes or plasticizers such as those found in all PVC page protectors.

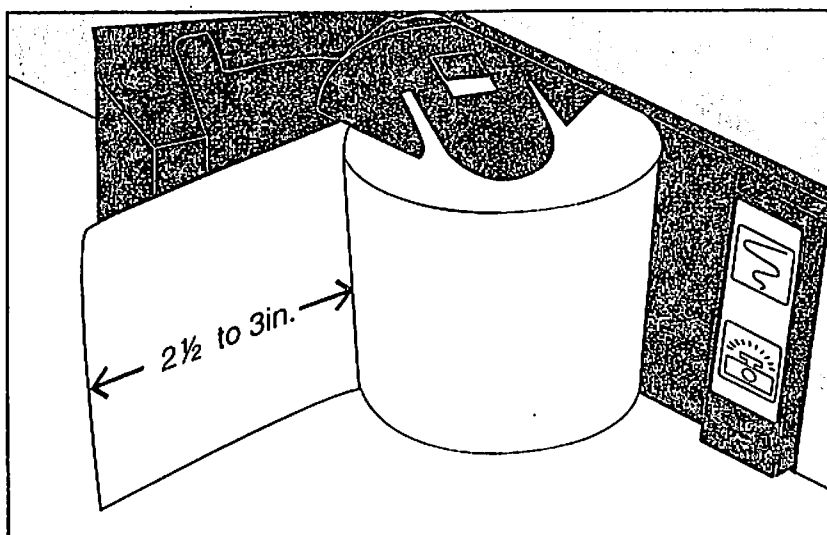


Figure A-2. Paper Loading

Paper Loading

Follow these steps to load paper in the printer.

1. Open the printer door by pressing the door latch.
2. Remove the spent paper core.
3. Place a new paper roll between the tabs of the paper holder. Paper should unroll counterclockwise. See Figure A-2, Paper Loading.
4. Begin to close the door while still holding onto and pulling about 2-1/2 to 3 inches of paper; then close the door completely. You should hear a 'snap' as the door latch is engaged.

5. Ensure the paper is properly aligned vertically in the paper slot.

Handling and Storing Printed Thermal Paper
Observe the following guide for handling and storing thermal paper.

- ☐ Do not scratch paper surface with any hard metal object, finger nail, or frictional heat. This may cause images to develop.
- ☐ Touching the paper surface with dirty or sweaty fingers may cause the printed image to fade.
- ☐ For long-term storage, store imaged thermal paper in the dark at an ambient temperature of less than 38°C and an R.H. of less than 80%.
- ☐ Do not expose to vinyls, plastics, shrink wraps, wet-toner copies, carbon papers or other thermal papers. Contact with these materials may result in fading or loss of the printed image.

Note

When in doubt about long-term storage conditions, store a photocopy of the thermal paper record.

**PRECAUTIONS,
CAUTIONS, and
WARNINGS**

The following general safety precautions should be observed during the operation, service, or repair of this module.

- ☐ If the accuracy of any determination value or printout is questionable, first check the patient's vital signs by alternate means and then check the printer or monitor.
- ☐ **⚠** For continued protection against fire hazard, replace only with same type and rating fuse.
- ☐ **DANGER:** Explosion Hazard. Do not use in the presence of flammable anesthetics.
- ☐ **WARNING:** Do not gas sterilize or autoclave.
- ☐ **CAUTION:** Electrical shock hazard. Do not disassemble printer. Refer servicing to qualified service personnel only.

OPERATION

Press the monitor's ON pushbutton to power on the monitor.

Operator Controls

The Model 8726 Printer has two buttons on its front panel: Continuous and Snapshot. These buttons control the type of printout. In addition, the DINAMAP™ PLUS Monitor has a Printer menu used to select:

- ☐ which waveforms are to be printed for continuous and snapshot printing. This waveform selection applies to any continuous or snapshot printout.

The selection applies independently of those parameters which are being measured. For example, if you select ECG and PRESS1 (Model 8720 only) to print and PRESS1 is disconnected/'off', the printer attempts to print PRESS1 even though there is no PRESS1 waveform; the printer prints a flat line for PRESS1.

A Continuous or a Snapshot keypress starts trace mode printing which always includes the ECG waveform.

- ☐ whether or not to enable alarm printing. If Alarm Print is 'on', the printer automatically prints a snapshot when a parameter or several parameters exceed an alarm limit.
- ☐ the printout of waveform (sweep) speed of 12.5 mm/sec or 25 mm/sec. Speed applies to continuous and snapshot printout only.
- ☐ whether or not to enable automatic text (in Auto group) printing. The options are 'off', print NIBP only, or print every 'x' minutes.

In addition to the Continuous and Snapshot buttons on the Printer which enable you to print, you can also print via the Freeze or the Trend menus.

Printer Preset/Default Settings and Print Priority

The Printer menu preset/default settings are listed below.

Group	Selection
WAVEFORM	ECG only
ALARMS	No alarm print
AUTO	Off
SPEED	25mm/sec

The preset/default settings are indicated by an asterisk (*) preceding the selection in the Printer menu.

You can change the default settings. The monitor will remember whatever settings in effect at power off and will return those same settings at the subsequent power on.

WAVEFORM		ALARMS	
* ECG only		Alarm print	
ECG and PRESS1		* No alarm print	
ECG and PRESS2			
AUTO		SPEED	
* Off		12.5 mm/sec	
		* 25 mm/sec	
NIBP		Standby	
MANUAL (--)			
Mains AC		SpO2	
Main → System → Printer			
Group	Select	↑	↓
			Set

Figure A-3. Printer Menu with Preset/Default Settings

Note

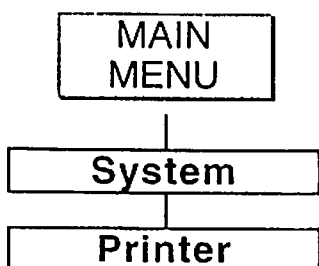
Speed applies to Continuous or Snapshot printing only. Frozen waveforms *always* print at 12.5 mm/sec.

Note

Model 8710 Series Monitors allow one waveform (ECG) option.

Printer Menu

1. To enter the Printer menu, press System in the Main Menu. See Figure A-3, Printer Menu.
2. Press Printer.



Group

Select

Set

3. Press Group to move through Waveforms, Alarms, Speed, or Auto (described on the next page) to make changes in the particular group.
4. Press Select to make your choice within the Waveform, Alarms, or Speed Group, that is: ECG only, ECG and PRESS1, or ECG and PRESS 2 in the Waveform group; and Alarm Print or No Alarm Print in the Alarms group; and sweep speed printout at 12.5 mm/sec or 25 mm/sec in the Speed group. (The sweep speed of the waveform onscreen is *independent* of the Printer waveform speed printout. For example, the waveform onscreen (sweep) speed can be at 25mm/sec but that same waveform can be printed at 12.5 or 25mm/sec.)
5. To put your choice into effect, press the Set key. The current choice is indicated by an asterisk (*).

NIBP Determination

↓			↓			↓		
Time		14:28	Time		14:35	Time		14:43
Date		08/02	Date		08/02	Date		08/02
Rate	bpm	80	Rate	bpm	80	Rate	bpm	80
SpO2	%	98	SpO2	%	98	SpO2	%	97
NIBP	mmHg		NIBP	mmHg	116/69	NIBP	mmHg	
(Mean)	mmHg		(Mean)	mmHg	(80)	(Mean)	mmHg	
Tempr.		98.6F	Tempr.		98.6F	Tempr.		98.6F
PRESS1	mmHg	120/79	PRESS1	mmHg	120/79	PRESS1	mmHg	120/79
(Mean)		(96)	(Mean)		(96)	(Mean)		(96)
PRESS2	mmHg		PRESS2	mmHg		PRESS2	mmHg	
(Mean)			(Mean)			(Mean)		

Figure A-4. Printout Every 15 Minutes with NIBP Determination Sandwiched Between 15-Min. Intervals

PRINT PRIORITY

Print priority is listed below.

Print Priority

- | | |
|----------------|-----------|
| 1. Continuous | 4. Trend |
| 2. Snapshot | 5. Freeze |
| 3. Alarm Print | 6. Auto |

AUTO (Group)

↑ or ↓

6. When you choose AUTO, the Select soft key disappears and up (↑) and down (↓) arrow soft keys appear.

Each up arrow keypress steps through NIBP; and 1, 5, 10, 15, 30, 45, 60, 120, and 240 minutes; and then back to 'Off'. Each down arrow keypress steps through the same choices, but in reverse.

If your choice is NIBP, a printout occurs approximately 10 seconds after every NIBP determination, including Stat mode.

The (x) minutes choice will give a printout every (x) minutes, and after every NIBP determination. For example, if Auto is set to print every 15 minutes and an NIBP determination occurs during the 15-minute interval, the printer will print the NIBP determination in addition to the 15-minute printout. Refer to Figure A-4 and note the times. This printout is somewhat similar in appearance to a tabular (text) printout via the Trend menu but it is different; this column includes NIBP measurements as well as any other vital sign measurements.

Set

7. When you have selected your choice in the Group, press the Set key. The asterisk then will appear in front of your (Set) choice.

PRINTING MODES

There are three (3) printing modes: Trace/Waveform, Freeze, and Trend. Trace printing is enabled via the Continuous or Snapshot keys on the Printer. Freeze and Trend printing is enabled via the soft keys on the monitor in the appropriate menu.

See Figures A-5 through A-10 for samples of printouts; pay particular attention to the explanations or callouts accompanying the figures.

Trace/Waveform Mode

Trace/waveform mode prints one or two waveforms. These waveforms can be printed in Continuous or Snapshot form. The printer always prints an ECG waveform; the second waveform (Model 8720 only) is selectable in the Printer menu.

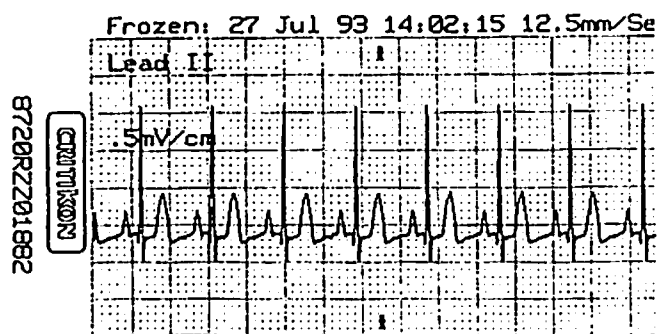


Figure A-5. Frozen Waveform Printout (12.5mm/sec.)

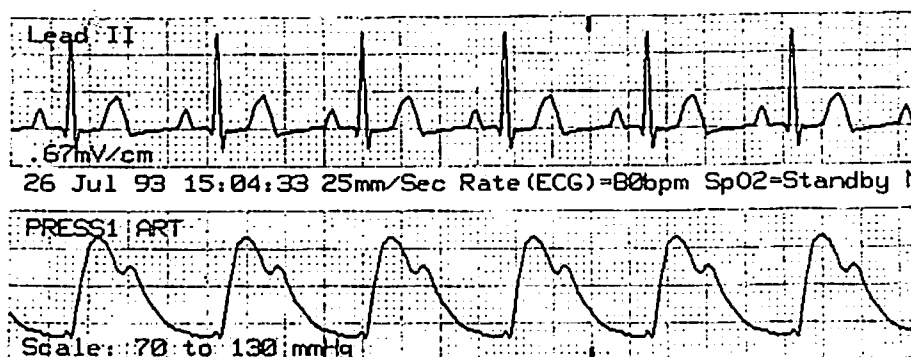


Figure A-6. Snapshot Printout with 2 Traces/Waveforms

8720RZZ01882	CUTKON	Time	09:45	
		Date	07/27	
		Rate	bpm	80
		SpO2	%	
		NIBP	mmHg	113/77
		(Mean)	mmHg	(90)
		Tempr.		98.6F
		PRESS1	mmHg	120/79
		(Mean)		(96)
		PRESS2	mmHg	
		(Mean)		

Figure A-7. NIBP Print Only

Time	13:22	13:17	13:16	13:11	13:09	13:04	12:59
Date	07/27	07/27	07/27	07/27	07/27	07/27	07/27
Rate	bpm	80	80	80	80	80	80
SpO2	%	97	97	96	97	—	
NIBP	mmHg		107/73		105/74		
(Mean)	mmHg		(91)		(84)		
Tempr.		98.6F	98.6F	98.6F	98.6F	98.6F	98.6F
PRESS1	mmHg	120/79	120/79	120/79	120/79	120/79	120/79
(Mean)		(96)	(96)	(96)	(96)	(96)	(96)
PRESS2	mmHg						
(Mean)							

Figure A-8. Tabular (Text) Trend Printout

HOW TO PRINT IN TRACE/WAVEFORM MODE

Trace/waveform printing starts and stops in several ways.

You can start a Continuous printout with a Continuous keypress; to stop the printout, press the Continuous key again.

Start a Snapshot printout by pressing the Snapshot key. A Snapshot printout stops automatically after 30 seconds *unless* extended by a patient alarm occurring while a Snapshot printout is in progress if Alarm Print has been selected in the Printer menu. Press Continuous twice to stop a Snapshot printout.

Printing stops when the battery gets low or a system or printer alarm occurs.

Trace/waveform mode starts automatically if you have Alarm Print 'on' and a patient out-of-limits alarm occurs. This printout stops after 30 seconds unless it is extended by the occurrence of another patient alarm while the printout is in progress.

If you press the Continuous key once while a Snapshot or an Alarm printout is in progress, the printer changes to Continuous mode and continues printing. Pressing Continuous again will stop printing.

ALARM PRINT

If Alarm Print is 'on' or enabled, the alarm printout occurs under the following circumstances:

NOTE

Only parameter out-of-limits alarms cause an Alarm Print. System alarms and procedural alarms (such as LEAD OFF) do not cause an Alarm Print.

- ☐ if a parameter is out of limits, the out-of limits parameter and alarm limits are printed;
- ☐ if a new alarm occurs while any snapshot or continuous printing is in progress, the new alarm is also printed; and
- ☐ if a new alarm happens while printing in snapshot mode, the snapshot time is also extended.

NOTE

Printed waveforms are delayed by 8 seconds to capture the data leading up to the moment the printout was triggered. The alarms descriptions are not printed immediately as they happen but are delayed by 8 seconds to align on the printout with the time they actually occurred.

Freeze Mode

Freeze mode starts when you press the FREEZE key on the monitor's front panel. The freeze mode captures six (6) seconds of an ECG waveform and displays it onscreen at 12.5mm/sec (speed). When you print the frozen waveform, it will printout at a (sweep) speed of 12.5 mm/sec—the same sweep speed as that depicted onscreen. All squares of the grid are spaced at 5 mm x 5 mm with lighter dots at 1 mm spacing; units in vertical division are spaced at x mV/cm, where "x" varies depending on space available for the largest waveform to display.

The description "Frozen" and "Lead xx", and the time at which the frozen waveform was captured is shown on the printout. Refer to Figure A-5, Frozen Waveform.

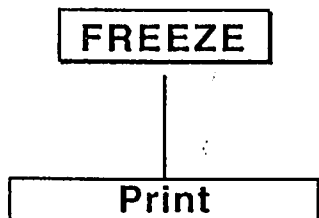
HOW TO PRINT IN FREEZE MODE

In addition to the freeze waveform display onscreen, the FREEZE keypress brings up the Freeze menu where the Print soft key label appears.

Press Print to print the waveform.

Printing stops when the frozen waveform has been printed.

Any Continuous or Snapshot keypress stops Freeze mode printing and starts Trace mode printing (that is, continuous or snapshot). An alarm snapshot supercedes freeze mode printing if Alarm Print is 'on'/enabled.



Trend Mode

Trend mode prints long-term print information in a tabular (text) format. The same information that is displayed on the screen in the Trend menu is printed, but the data/record is in a different format from that which appears onscreen. Refer to Figure A-8, Tabular (Text) Trend Printout. All the parameter values are printed as they appear on the display; for example, dashes for invalid data or a blank for unavailable data.

In the Trend mode, you can print the records of one screen/page with a Print keypress or you can print all the records (approximately 300 lines) with a PrintAll keypress.

In Model 8710 Series Monitors, the Temperature (Temp), Press 1 and Press 2 lines do not appear.

HOW TO PRINT IN TREND MODE

Trend mode printing starts with a Print or PrintAll soft key press in the Trend Menu. In the Trend menu, display the desired screen or page you want to print, using the Older/Newer soft keys if necessary. Then press the Print soft key to print the displayed data or records. A Print keypress prints one screen or page in tabular (text) format.

To print a different screen/page, use the Older/Newer key to move to another page; then press the Print soft key again.

To print all records in Trend, press the PrintAll soft key. To stop this printout, press the Continuous key twice.

Waveform printing (continuous, snapshot/alarm) supercedes a trend printout-in-progress.

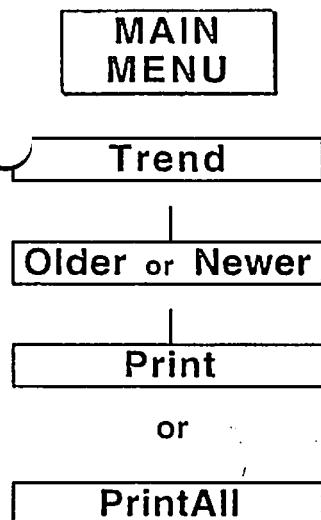


TABLE A-1. PRINTER/PRINTING Characteristics

Printer/Printing Characteristics in Trace/Waveform Mode		
	Action	Result
8710 or 8720	Printer Key: Following power on and prior to making changes in the Printer menu, A Printer keypress in the System menu,... If default settings are changed in the Printer menu, the settings or printer configuration in effect at power off...	...causes entry into the Printer menu with preset/default settings—indicated by asterisk—in effect. ...is the printer configuration in effect at the subsequent power on.
8710 or 8720	Continuous Key: A Continuous keypress... Another Continuous keypress... If in Snapshot or in Alarm Print, two (2) Continuous keypresses...	...starts a continuous trace/waveform printout based on Waveforms group selection. ...causes the continuous printout to stop. ...cause the printout to stop.
8710 or 8720	Snapshot Key: A Snapshot keypress...	...starts a 30 sec. snapshot trace/waveform printout, unless the time is extended by Alarm Print (if 'on') based on Waveforms group selection.
8710 or 8720	Group Key: In the Printer menu, each Group keypress...	...causes a move to the next Group, which is highlighted.

Printer/Printing Characteristics in Trace/Waveform Mode Continued		
	Action	Result
8710 or 8720	Select Key: In the Waveforms, Alarms, and Speed group in the Printer menu, each Select keypress...	...causes the 'boxed' option to move to another selection within the highlighted group.
8710 or 8720	↑ or ↓ Up or Down Arrow Keys: In the Auto group only, each Up or Down Arrow keypress...	...steps through 3 choices for printing: Off, NIBP, NIBP and/or (x) minutes time intervals.
8710 or 8720	Set Key: A Set keypress...	...causes a printer setting (indicated by asterisk) to change to the selection in the highlighted group.
8710 or 8720	If Alarm Print is 'on' in the Alarms group... ...only parameter out-of-limits alarms are printed. If a new alarm occurs during snapshot or continuous printing, the new alarm prints. If a new alarm occurs during snapshot printing, the snapshot time is extended.	
8710 or 8720	If either NIBP or (x) minutes is selection in Auto group... ...every NIBP determination will print, including stat mode.	

Printer/Printing Characteristics in Freeze Mode		
	Action	Result
8710 or 8720	Print Key: In the Freeze menu, a FREEZE keypress...	...starts a printout of the frozen waveform onscreen.
	A PRIOR MENU or MAIN MENU keypress...	...causes a return to the display previous to the FREEZE keypress.

Printer/Printing Characteristics in Trend Mode		
	Action	Result
8710 or 8720	Print Key: In the Trend menu, a Print keypress...	...starts a tabular (text) printout of one screen or page of records (onscreen) selected.
8710 or 8720	Older or Newer Keys: Each Older or Newer keypress...	...steps through an older or newer screen/page of records.
8710 or 8720	PrintAll Key: In the Trend menu, a Print/All keypress...	...starts a tabular (text) printout of the all available records.

ERROR CONDITIONS

If an error condition occurs, an audible alarm sounds and a message is displayed on the screen in the Alarm Message Field. For example,

- ☐ if the printer runs out of paper, the alarm sounds, the printer cannot print, and the message R91 PAPER OUT or R91 (abbreviated message) will display in the message field.
- ☐ Likewise, if the door is open, the alarm sounds, the printer cannot print, and the message "R92 Door Open" or R92 will appear in the message field.

If a *system* error occurs, an R97 Printer Error message is shown. If an R97 message occurs, refer to qualified service personnel.

Error messages: R91 Paper out
 R92 Door open
 R97 Printer Error

The Silence key clears the alarm condition, that is, a Silence keypress silences the audible Printer alarm only and causes the message to disappear.

PERFORMANCE SPECIFICATIONS

WRITING METHOD	Direct Thermal
RESOLUTION	Vertical: 200 Dots/Inch (8 Dots/mm) Horizontal: 800 Dots/Inch (32 Dots/mm)
CHART SPEEDS	12.5 mm/sec, 25 mm/sec
PRINT WIDTH	48 mm

ACCESSORIES

Reorder Code	Description
8730	Thermal Printer Paper
	Ten rolls per Box, 100 feet per roll
633-132	12 V Sealed Lead Acid Storage Battery, one each